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ABSTRACT

These eight papers on guidelines and standards for learning resources programs at the college and university level address such topics as technological communications services, instructional development, diffusion/adoption, production, telecommunication, utilization, facilities, and budgeting for learning resources programs. Many charts supplement the discussions. Among the more technical information provided by the document are a listing of major equipment needed to meet estimated minimum needs for mechanical preparation and creative production activities and a detailed table of space allocation for a library communications center. (JD)

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COLLEGE LEARNING RESOURCES PROGRAMS: A BOOK OF READINGS

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Foreword

Six years ago then President Robert Gerletti established a large task force of professionals within AECT charged for developing program standards for formal educational programs at all levels. That task force divided itself four ways and ultimately produced two sets of guidelines: (1) for educational communications and technology programs at the elementary and secondary level, and (2) for two-year post secondary institutions. The elementary and secondary programs guidelines document was developed jointly with the American Association of School Librarians and is a major revision of a 1969 document with the new title "Media Programs: District and School". The guidelines for two year post-secondary institutions were developed jointly with the American Association of Community and Junior Colleges and the Association of College Research Libraries and is entitled "Guidelines for Two-Year College Learning Resources Programs".

The subgroup of the Standards Committee which addressed the development of Guidelines for Learning Resources Programs for Colleges and Universities knew at the outset that they had a very difficult job. The fact that this document is being published six years later attests to the difficulty of the task.

Everyone who was involved in this work is dissatisfied with the current book of readings. There are two difficulties with this book: that the areas which are discussed do not constitute the universe of concerns with learning resources programs at the college level, and that the areas which are discussed are not addressed from a common framework (such as the domain of educational technology or some other paradigm). In spite of these shortcomings, the need in our field is so great for some professional advice concerning college and university level programs that the Board of Directors and members of the current committee feel the results should be published in this form at this time.

This work has proceeded under the regimes of seven AECT Presidents: Robert Gerletti, Robert Heinich, Jerrold Kemp, Robert Jarecke, Gerald Torkelson, Harold Hill and Richard Gilkey. The original chairperson of the Program Standards Committee of AECT was John Dome; and the two successive chairpersons of this College Guidelines Task Force were Gaylen Kelley and David Crossman. Besides the contributing authors to this volume, the following committee members donated their efforts during this period: Franz Frederick, Fred Harclerod, and William Fulton. The Association is grateful to the efforts of all of the aforementioned individuals, but most particularly to the authors whose work made this publication possible.

Howard B. Hitchens
Executive Director

Technological Communications Services in Higher Education

JAMES W. BROWN, San Jose State University

INTRODUCTION

Recent changes in higher education in the United States suggest the need to reexamine some long-held but largely untested assumptions. These changes have to do with: (1) the numbers and variabilities of individuals seeking higher education today; (2) the continuing traditional character of college teaching, which has often failed to adapt to changing needs; (3) the nature of several new demands now placed upon higher education—such as demands for expanding continuing education and for offering external degrees; and (4) the opinions of legislators and taxpayers concerned with the financial support of higher education who question the efficiency of the present system.

There is no doubt that college and university enrollments are increasing. At the turn of the century, only 115,000 students (of the country's million people) were enrolled in institutions of higher learning in the United States. By 1970, this figure increased to 7.4 million (of a total population of about 200 million). The confident prediction for 1980 is that more than 11 million will be enrolled in college. Clearly, unless the current motivations of college-age students and their parents change radically, these enrollments will continue to grow for some time.

Enrollment of growing numbers of ethnic minority and economically disadvantaged students has increased the variability of motivations among today's college population. No longer is a college education the almost exclusive property of economically and ethnically favored groups. Other types of students, most of them motivated by a desire for upward economic mobility and security, attend college in increasing numbers. There is considerable impatience among these newcomers with taking "useless" courses that fail to match their vocational goals. No longer are students generally content to accept, without question, the irrelevant or the unreasonable. They are far less reluctant than formerly to insist upon participating in making instructional decisions, such as those pertaining to the ends and means of education, alteration of systems governing the awarding of credits and grades or alternatives about required attendance and independent study. College instructors, who have long been oriented toward the unilateral unquestioned imposition of learning tasks, experience unfamiliar (often public) criticisms of and pressures to change their approaches. Nearly every aspect of college teaching is open to such examination.

The aptitude of students now enrolling in colleges and universities is similarly varied. This variation is revealed both in the differences in the distribution of aptitude scores among different types of institutions and in the course structures these institutions offer. Professors whose past experiences have been limited largely to instructing students of high verbal ability find new problems in communicating abstractions to students who lack this ability. They find it difficult to capitalize on the different (but valuable) skills and insights

born of the firsthand experiences and cultural contacts of these minority and disadvantaged students—experiences and contacts which have unmistakable value for careers they have chosen.

On the other hand, taxpayers, legislators and boards of trustees question the input-output efficiencies of higher education and sometimes insist on accountability in the expenditure of funds supporting institutions. To them, the significant problem seems likely to remain what it has always been: how to support higher education. It seems likely that whether or not professors and administrators agree, much more effort than formerly will be given to seeking evidence of *efficiency* in the use of resources to achieve maximum increment in educational product.

Reconciliation of these differing requirements and expectations of professors, students and taxpayers with regard to higher education clearly calls for innovation. Efforts to provide professors with the tools and resources they need to teach and the time they need to change their approaches, to give the students the relevancy and freedom they seek to manage aspects of their own learning and at the same time to satisfy the input-output economic efficiencies sought by taxpayers and legislators suggest the applicability of the systematic approach of "instructional technology" as a solution to some of the problems of higher education.

What are the elements of this approach? In its simplest form, instructional technology involves the systematic interrelating of: (1) instructional goals, or purposes; (2) the status, capabilities, goals and needs of students participating in the system; (3) the status and capabilities of human resources—the professors and other professional, paraprofessional or the technical staff associated with teaching; (4) the status and capabilities of applicable non-human resources—the educational "software" or learning resources collections, instructional equipment, libraries, classrooms and laboratories, learning resource centers—of the institution; (5) the instructional management of the system which derives its clues for change and improvement from cybernetic feedbacks of a scientific evaluation of all aspects of the program.

The system of instructional technology envisioned in the guidelines that follow illustrates a program in support of college and university teaching and learning that attends to each of the foregoing elements through: (1) moving from vagueness as to purposes of instruction toward clear and precise statements of objectives reflecting intended behavioral changes of students; (2) identifying and adapting to the special characteristics of students participating in the instructional system to free them from lockstep requirements and permit more individualization and independence in studies and tailoring learning programs to their individual learning styles and capabilities; (3) identifying the particular strengths and interests of professors, educational specialists (including instructional technologists), paraprofessionals, technicians and others who may form team combinations or otherwise be used in carrying out various instructional assignments; (4) inventorying, classifying and increasing access to institutional resources required to support learning/teaching—some requiring and some not requiring human intervention; and (5) managing the instructional system to insure supportive, corrective and more efficient applications of effort and resources to achieve objectives and improve educational products of the system.

Instructional technology is thus of direct concern to higher education. The resources and services it contributes are *integral*, not peripheral, to conducting systematic teaching and learning. Instructional technologists must act on the understanding that the programs they provide assist in achieving instructional objectives. Therefore, their resource collections cannot remain as inert repositories of information waiting to be called into service; they must be used actively as significant elements of the instructional program. Instructional technologists and their staffs provide an essential interface between instructional resources and resource services and the teaching and learning requirements of professors and students.

GENERAL GUIDELINES FOR LRC's Learning Resources Centers*

Professors, students and others who participate in the systematic approach to teaching and learning in higher education are given convenient access to a full range of learning resources' services, equipment and facilities. Included among the recommended learning resource centers for colleges and universities are: (1) libraries, (2) museums, (3) technological communications services, (4) computer services and (5) the press.

Administrative Relationships of Learning Resources Centers

All five of the foregoing resources centers appear in our recommended organization plan (see Fig. 1). They are coordinated at a dean's or vice-president's level within the functional responsibility for Learning Resources and Services for the entire institution. (Other terms are often used to designate the program center; at this writing, state and local conditions often mandate the term used.) Placement of responsibility at this high level insures proper orientation of the several services, to serve the needs of and to provide leadership with respect to instruction, assure the elimination of undesirable duplications of some services and guard against the neglect of others.

Several guidelines apply to the work of the Learning Resources Centers: (1) each provides essential program design, resource selection, production, utilization and related technical services appropriate to its stated purposes; (2) each is oriented toward the improvement of teaching and learning within the institution; (3) responsibilities and functions of each center are clearly defined and available in writing; (4) policy coordination of the work of each center is achieved through appointment of a central advisory committee of faculty, students and administrators whose recommendations are made to the Dean of Learning Resources and Services or other responsible administrator.

TECHNOLOGICAL COMMUNICATIONS SERVICES: MANAGEMENT FUNCTION

Colleges and universities are urged to provide as one of their Learning Resources Centers a Technological Communications Services unit (see Fig. 1) that has as its principal responsibilities performance of:

- Instructional Development Functions
- Production Support Functions
- Utilization Support Functions

Further details of the nature of these three functions, as well as recommended guidelines for establishing and administering them, will be provided in later sections.

Management of the Technological Communications Services organization requires attention to long and short-range planning, budgeting, implementation, and evaluation and refinement of programs to meet changing requirements.

Planning and Budgeting Guidelines

Planning and budgeting for the program of the Technological Communications Services organization should recognize other plans that are also to be developed for other Learning Resources Centers (libraries, museums, computer services, the press or others) and should be closely integrated with and supportive of institutional, school or college, and departmental curricular objectives and purposes.

These activities should involve, in appropriate ways, all who will be affected by them—the TCS director, his professional staff members and support personnel, as well as representative faculty and student users of the service. They should take into account the current

*Center, in this usage, refers not to a physical facility, but to a program or cluster of programs. The usage of the term is similar to that in "cost center."

status of the total TCS program, as well as those elements that should be continued, those that should be restricted or discontinued, those that should be expanded and those that should be introduced. New elements should be described in "proposal" form and should be accompanied by statements of purposes to be served and objectives to be reached within certain time frames and at certain quality levels. Criteria by which to judge achievement of objectives should also be supplied.

Expenditures of budgets should permit substitutions and reallocations of items as necessary to support justifiable program changes, provided total expenditures remain within predetermined limits.

Implementing the TCS Program

The TCS director should be responsible, within limitations of applicable policies and lines of authority, for performing the duties and functions assigned to him. Internal administration of the TCS should involve staff participation.

Appropriate statistical data should be gathered concerning the implementation of the TCS program to provide corrective or reinforcing feedback on its operations. Information concerning the purposes, accomplishments and needs of the TCS program should be shared through newsletters, information meetings or other means, with individuals interested in its operation.

Evaluating and Refining the TCS Program

Costs of various subprograms within the operation of the TCS should be monitored and evaluated as to their "cost-effectiveness." Continuous effort should be made to determine the suitability (validity) of program objectives, the degree of their achievement and the need for corrective action to insure coordination of those objectives and the capability of the TCS unit to achieve them.

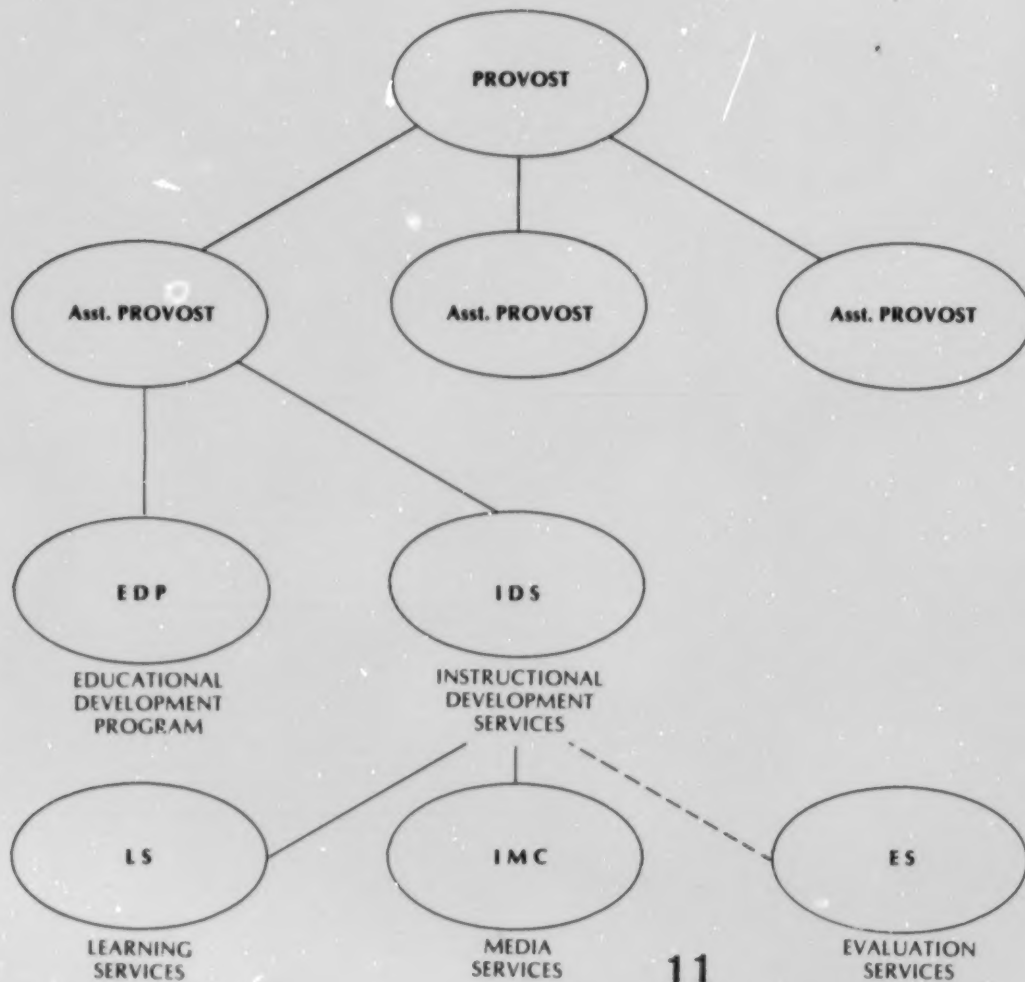


Figure 2

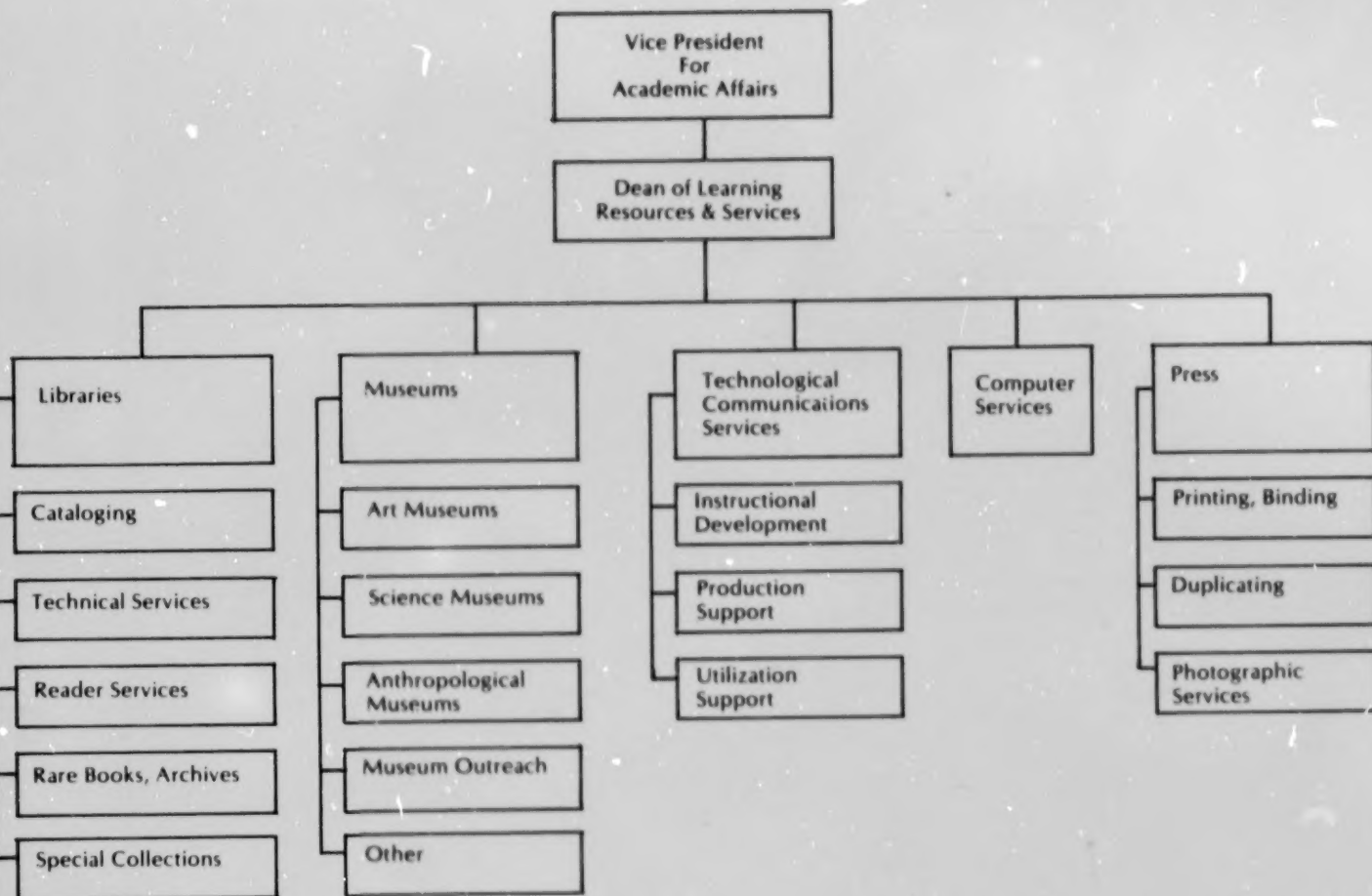


Figure 1. Sample Organization of Instructional Resources and Services

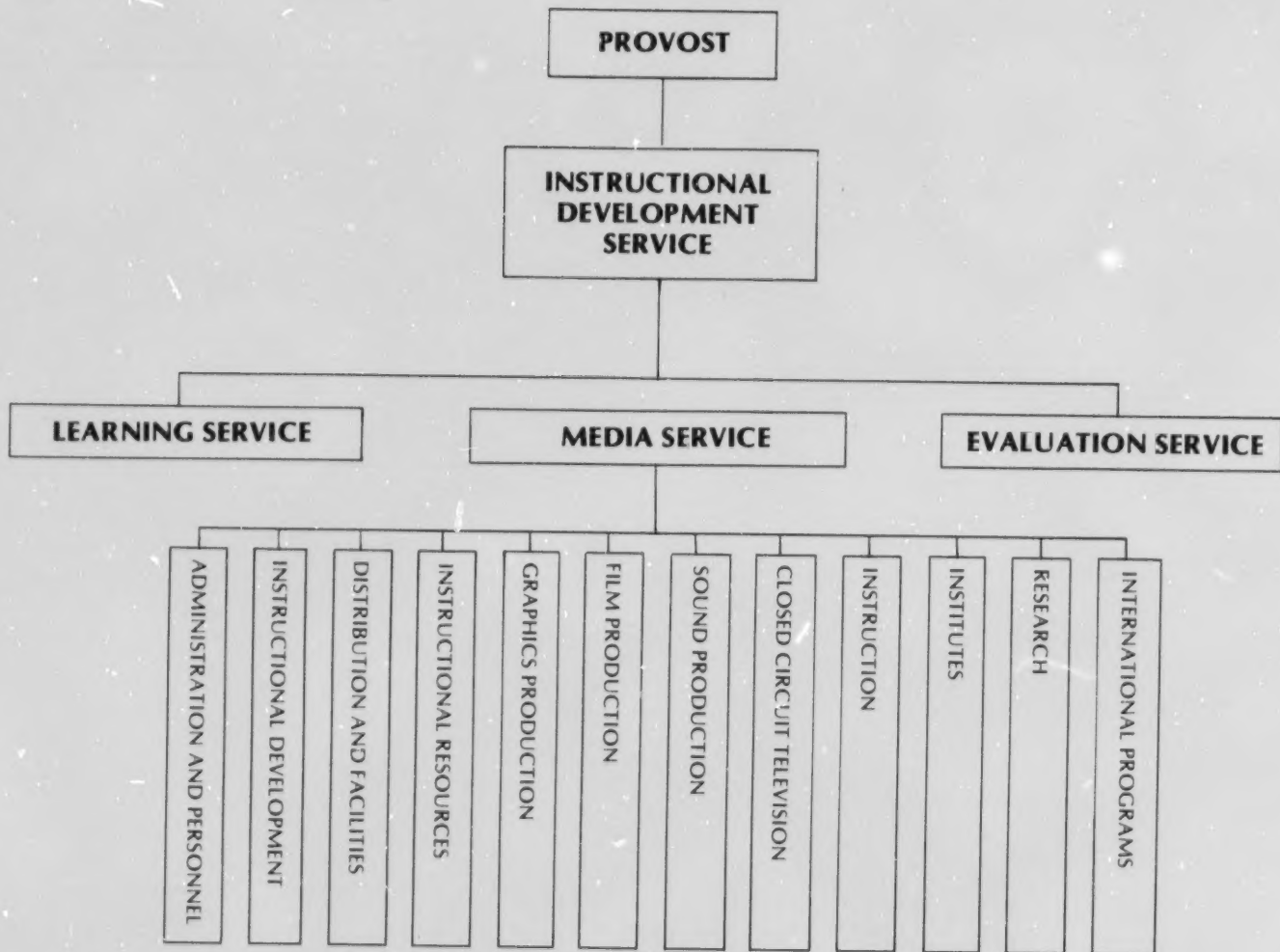


Figure 3
UNIVERSITY DIVISION OF INSTRUCTIONAL SERVICES

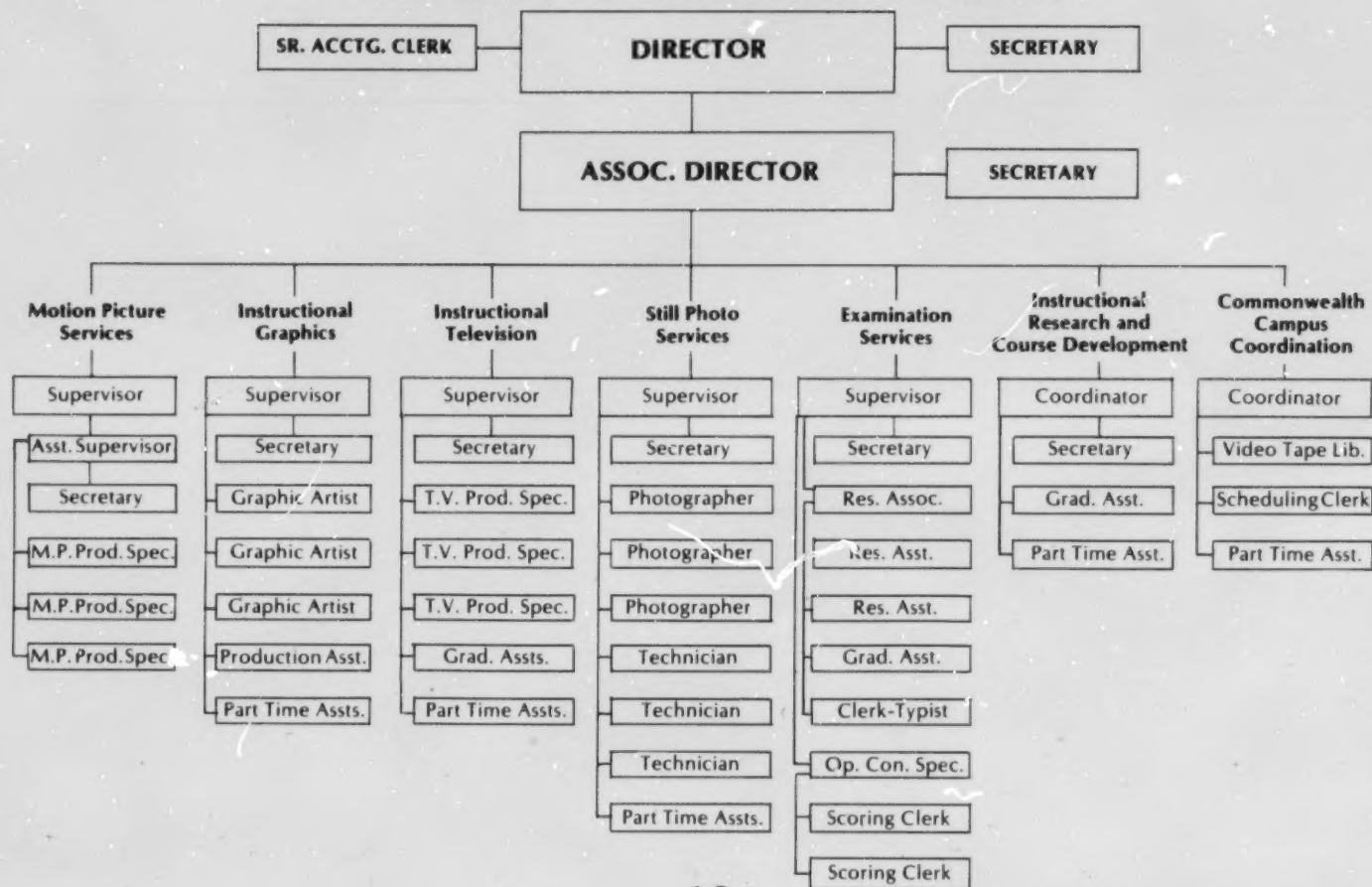


Figure 4
TABLE OF ORGANIZATION

OFFICES OF LEARNING RESOURCES
UNIVERSITY OF WASHINGTON
PROPOSAL

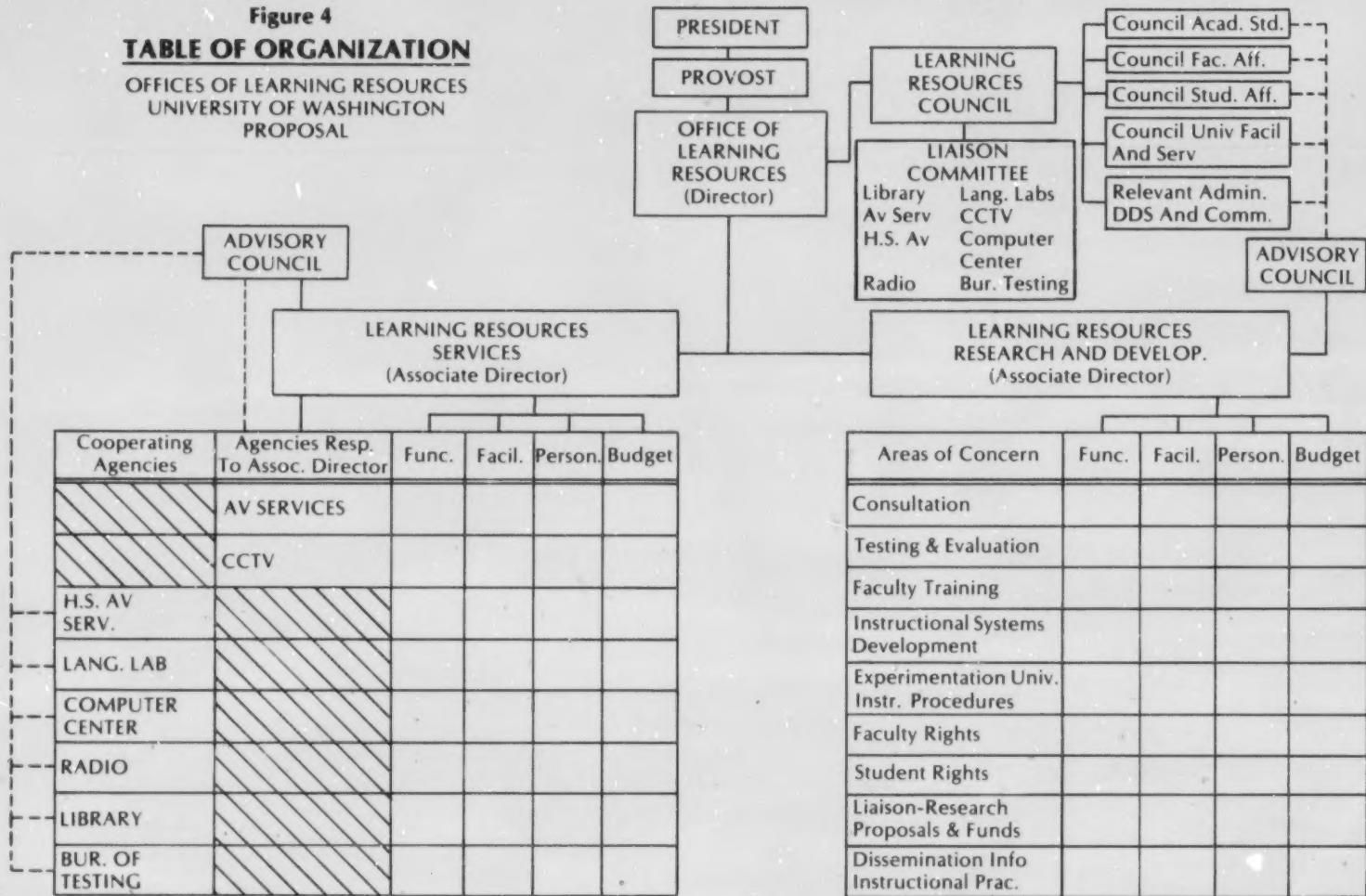


Figure 5

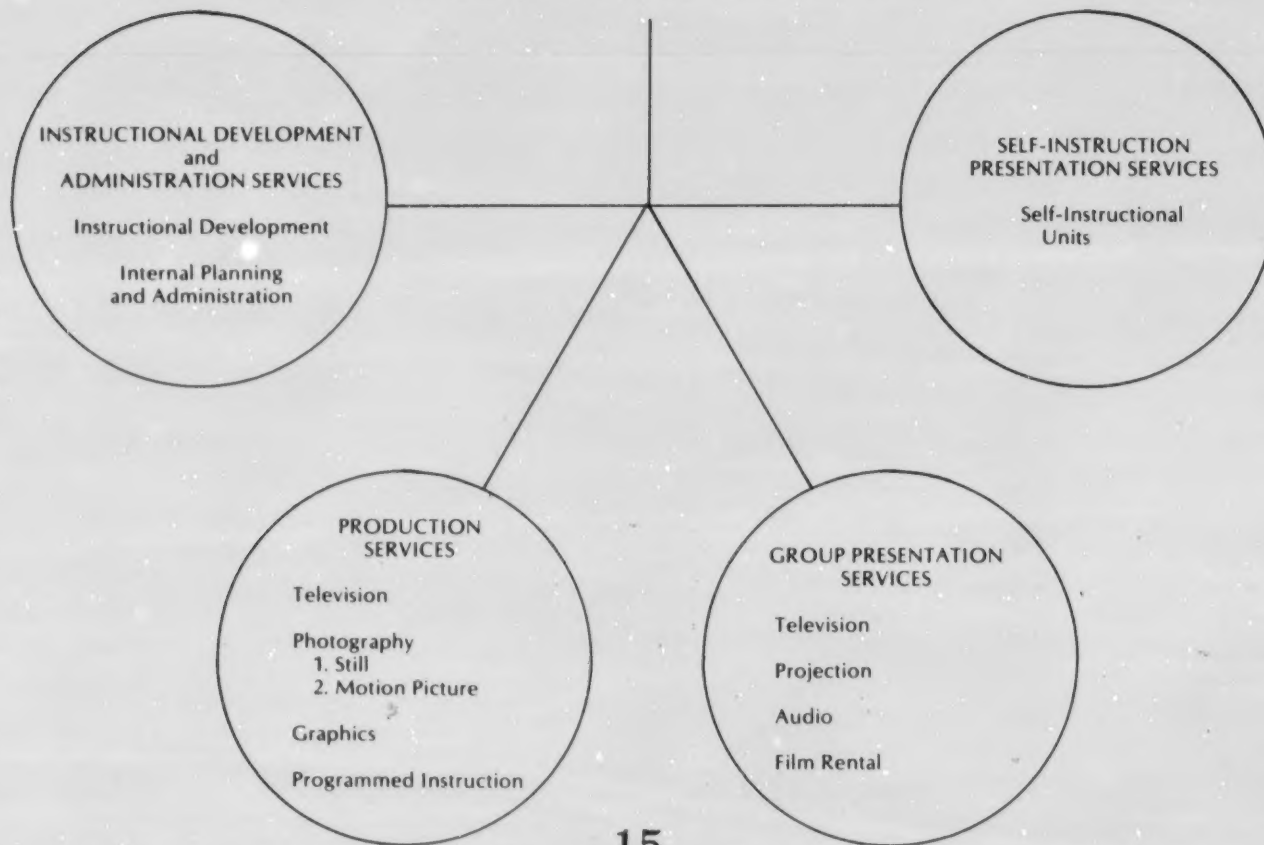
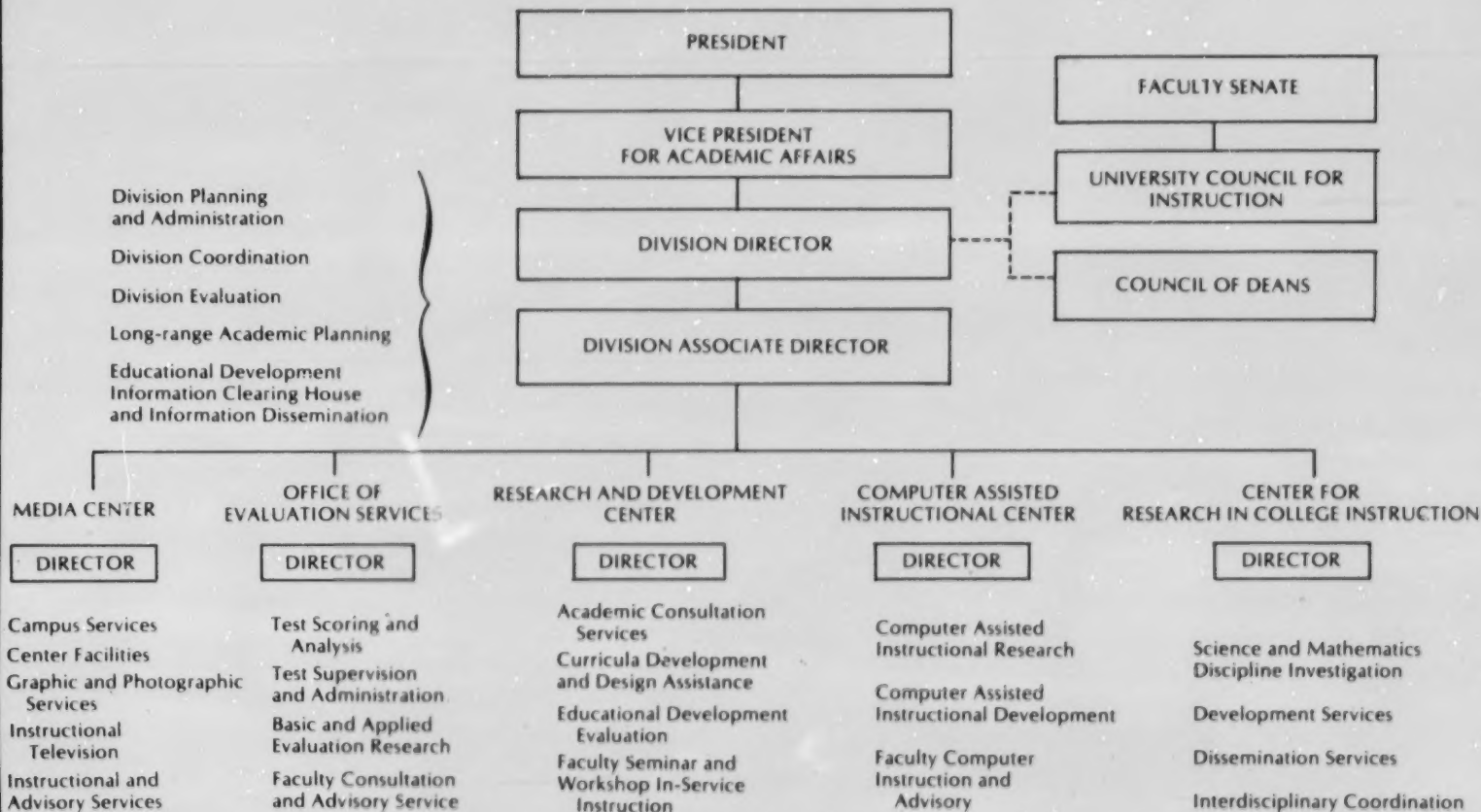
**CRITERIA FOR PLANNING THE UNIVERSITY RESOURCES CENTER
UNIVERSITY OF CALIFORNIA SYSTEM**

Figure 6
FLORIDA STATE UNIVERSITY
DIVISION OF INSTRUCTIONAL RESEARCH AND SERVICE



The Instructional Development Function

MENDEL SHERMAN and THOMAS SCHWEN, Indiana University

INTRODUCTION

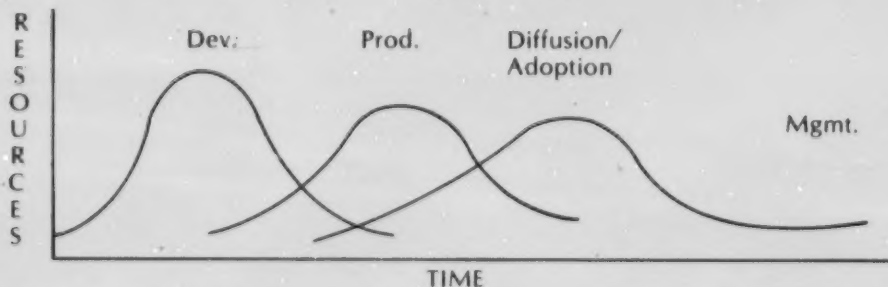
The term "instructional development" is associated with a variety of meanings. The term will be used here as a general rubric for that portion of the technology process which includes the analysis of the learner and the learning area, the instructional problem, the specification of materials and strategies for the behaviors being manipulated and the simultaneous management and evaluation of the aforementioned processes. In a normal institutional situation, this includes the earliest intuitive decisions.

The functions of instructional development and the other technological processes are so interwoven and complex that they cannot easily be differentiated. This is especially true where the technological process functions reside in one or two generalists. However, the basic assumption of this chapter is that successful management of the technological process is dependent on the administrator's ability to draw distinctions between and among the various functions.

RATIONALE

In drawing the distinction between development, production and diffusion/adoption, the work of Glennan¹ and Schutz² has been modified. The development, production and diffusion functions overlap (see Fig. 1). The production specialist must be involved during the earliest phases of strategy or product specification and must continue with the project until the final modifications are made and a fully produced validated product is installed. The diffusion/adoption function begins at least as early as the final strategies are being selected in the development function and continues throughout the production, dissemination, demonstration and adoption stages until the client is able to manage the instructional system without the continuous assistance of one or more of the technological specialists.

Figure 1



¹T. K. Glennan, Jr., et al. *Strategies for R & D*. New York: Verlag, 1967, Chapter 2.

²Richard E. Schutz. "The Nature of Educational Development," *J. R & D in Ed.*, Winter, 1970, 3 (2).

Three other important themes can be observed in the literature on development. The emphasis on a scientific methodology or process can be observed in the National Science Foundation's 1965 definition, "... the systematic use of scientific knowledge directed towards the production of useful materials, devices, systems or methods, including the design and development of a prototype and process. . ."

A second theme, the overriding objective or purpose of development is discussed in Davies description of efficiency and effectiveness¹. The instructional developer's overriding objective is to create both effective and efficient improvements in the instructional environment. Effectiveness is best indicated by mastery of all of the learning objectives, a positive affect towards the learning area and a minimum amount of student time invested in the learning process. Efficiency is fairly well understood in instructional circles and can be characterized by sound management of the instructional environment—for example, neat and well-prepared instructional materials, a warm and pleasant instructor/manager and well-organized instructional procedures—or, in other words, a psychologically hygienic environment.

The third characteristic of development—invention—is represented in Henry Brickell's definition. Brickell defined development as, "the invention design, even the careful step-by-step engineering of new and better ways of doing things in education. . ."

MANAGEMENT AND IMPLEMENTATION

In planning for the management and implementation of instructional development it is worth assessing personnel in the context of the complexity of the invention process required across tasks (see following table).

A COMPARISON OF LEVELS OF PERSONNEL TASKS AND EXPECTED OUTCOMES IN THE MANAGEMENT OF INSTRUCTIONAL DEVELOPMENT		
<i>Personnel</i>	<i>Task</i>	<i>Outcomes</i>
Level 3 Advanced research and development competency	Complex development in complex behavioral domain	Significant new knowledge; highly effective and efficient solutions
Level 2 Highly skilled development competencies	Difficult development of reasonably well-understood behavioral domain	Reasonably effective and efficient solutions
Level 1 Moderate development	Moderate adjustments of behavioral domains	Usually efficient and moderately effective solutions

At level 3, the personnel are engaged in the development of complex, poorly understood behaviors which require advanced theoretical research and development skills. These skills are required for the creation of effective and efficient instructional systems. Quite often, the by-product of development at this level is the production of new theoretical or methodological knowledge about the behaviors being manipulated. An example of a task at this level is an advanced problem-solving skill or an affective or attitudinal change in any discipline. Level 2 falls between level 3 and level 1, discussed below.

Level 1 is the lowest and most basic level of development. At this level, moderate competencies in the development of well-understood behaviors frequently result in efficient and reasonably effective instructional systems. Commercially prepared materials are often adapted to local needs. Recall tasks, certain psychomotor skills, simple management skills or procedures are examples at this level."

¹Ivor K. Davies. *The Management of Learning*. London, England, 1971.

The utility of such a scheme is evident when the instructional resources are committed to projects. Managers of the development service can assign personnel to projects in a differentiated manner as a function of the task to be learned and the priority that must be placed on outcomes.

The operational modes of developers vary considerably from institution to institution. However, two "pure" strategy types can be observed in development activities. In the first strategy, the *upgrading of faculty development skills* is seen as the primary method of realizing instructional gains. The major assumption is that improved instructional skills by the faculty provide the optimal solution in developing effective instruction. The major advantage of this method is in the number of faculty members affected. Under the scrutiny of development specialists, instructional losses can be minimized and modest levels of effectiveness can be attained.

In the second general strategy, the *primary focus* of attention is on *developed instruction*. The major assumption of this approach is that the development specialists can be most efficient (amount of instruction developed) when the client serves primarily in the role of content expert. The expectation of optimal outcomes is based on the premise that the instruction developed will be more effective and efficient if this strategy is used. The apparent gains in the quality of instruction developed are achieved at the expense of the potential number of faculty involved.

As is characteristic of all dichotomies, these strategies seldom exist in their pure forms. Most development centers use both strategies, and very little investigation of the relative merits of the two strategies has been performed. Once the development specialist has left the development center, little information can be obtained regarding the faculties' transfer of development skills to new program situations.

Instructional development discussed in the absence of benefits is expensive. The instructional development specialist and his support staff constitute additive or supplementary instructional costs. In addition, the development function is time-consuming, particularly when the instructional need requires the most complex level of invention. These factors have been of primary concern to the developers in their efforts to minimize the labor-intensive characteristic of instruction. The savings of multiple faculty salaries which result from the development and installation of a semi-self-contained instructional system can be extremely attractive to administrators and developers concerned with justifying their respective budgets.

The complex character of the development function and the recency of its institutionalization among colleges and universities mitigates the statement of precise qualitative standards. The following data are descriptive guidelines which will need to be adapted to specific institutional settings:

**QUANTIFICATIONS:
RESOURCES NEEDED FOR THE INVENTION OF
COMPLEX INSTRUCTIONAL SYSTEMS**

Development personnel with the following competencies:

Analysis	Analysis, learner analyses, objectives, writing; classification of outcomes by behavioral theories.
Synthesis	Creation of product specifications from analysis; matching specifications with media characteristics.
Evaluation	Raising appropriate questions; selecting or fabricating evaluation models or procedures; selection or creation of a wide variety of instruments.
Research	Advanced competencies in research design and related methodologies.
Management	Personal interaction, controlling group behavior, controlling resources, ordering complex events, cost analyses.
Content Expertise	Sophisticated

Personnel Specifics

The number of professionals can be tied to expected outcomes. (See Faculty Development Outcomes, p. 17.) A differentiated staff, which includes two or three advanced professionals and three or four other, less well-trained professionals, forms an efficient work unit. The following remarks will be based on a work unit of this type.

Other Technological Professionals

There are as many administrative patterns as organizations. However, it is suggested that one full-time production specialist and one quarter-time diffusion specialist be deployed for each of the sophisticated developers.

Clerical Support

There will be above-average demands in three categories of clerical support—the receptionist, the manuscript production and the executive-support functions. Because developers and their associated staff members operate in a dynamic environment, the administrator will discover a need to staff all three of these functions. One-half clerical position for each full-time staff member is recommended.

Other Professional Services

There are several other types of professionals that will need to be related to the development function in one phase or another. Among these are test development specialists, research design experts, etc. The newer breed of evaluation specialists is particularly well suited to working in this environment. A one-quarter time position for each full-time developer would constitute a minimal investment.

Physical Resources

Facilities and Equipment

Space—The facilities should be centrally located, have a combination of several conference rooms and have individual office and additional private work space. The work space is often necessary to protect the faculty, clients and staff members from their routine concerns during the long periods of intensive creative work that are required in development. It is not uncommon for developers to spend from 40% to 60% of their working days attending meetings. Therefore, one conference room for every three or four developers is suggested.

Office Equipment—The constant cycle of meetings, deadlines and voluminous exchange of written documents will need to be supported with highspeed, good-quality duplication and copying equipment. At least one copying and one duplication machine are required to support each work unit of three or four developers.

Display Devices and Planning Boards—Small group display devices and large planning boards (cork, cloth-covered wall board, etc.) are essential for a successful operation. Whole walls of conference rooms and work space areas will need to be converted to planning boards. Small display devices are essential in supporting presentations in small meetings. The planning boards are required in the support of the complex analyses of behaviors, instructional systems, etc.

Telephone and Courier Service—All staff members will require telephones. Multiple trunk lines with appropriate secretarial receiving instruments will be required for the receptionist function. Also, access to rapid courier services is essential in the dissemination of the large volume of paperwork.

Capital Equipment Reserves—At least one of the technological services will require that some capital reserves be set aside for the technical support of instructional systems. The familiar auto-tutorial carrels are a single example of expensive installations associated with development projects.

Supplies and Expenses

Paper and Printing—There are always substantial costs associated with materials and instructional development.

Communications and Postage—Stationery needs are usually two and a half to three times above institutional norms established for faculty members.

Production Costs—These needs seem to coincide quite well with other guidelines stated elsewhere in this document.

Additional Comments—At least 25% to 35% of the total expenditures in support of development projects are invested in S & E production costs. The remaining 65% to 75% is typically invested in faculty or staff salaries.

Travel—Substantial investments in both employee and non-employee travel are suggested. Travel expenditures are required to cover visits by personnel to similar development projects in other institutions and/or to bring in related experts to compliment the skills of the development team. The travel requests of these staff members may be expected to be five to ten times more than typical faculty norms. These expenditures will be saved several times in economies in the development process.

RESOURCES RELATED TO INSTRUCTION SYSTEMS EXPECTED OUTCOMES

The above estimates were based on the requirements for complex invention of instructional systems. The following are typical descriptions of the time and output relationships.

Time

Approximately 40 to 70 hours of professional time (depending on the complexity of the problem)—developers, production, staff, diffusion, etc.—are required to develop one validated student hour of instruction.

Monetary Support

S & E support ranges from \$50 to \$150 for each hour of developed instruction. The materials are usually less satisfactory than materials designed for distribution or for sale. The costs vary as a function of the complexity of the production task; e.g., number and type of visuals, use of color. This observation excludes equipment support and development of either television or 16mm films.

Output

One competent developer and appropriate support staff can manage two or three course development projects simultaneously. The development of one validated course (@ 50 contact student hours) typically ranges from 18 months to three years.

FACULTY DEVELOPMENT OUTCOMES

Using the same work units the following observations are, generally, descriptive of output relationships when faculty skills are of primary concern.

Time

One competent developer will, generally, spend four to eight weeks with a faculty member in a tutorial arrangement. The faculty member may be able to manage from ten to twenty tutorials simultaneously. Group developer/faculty relationships are difficult to calculate. They are probably equivalent to ratios developed in support of seminar classes. Two or three seminars of 15 to 25 members each can be managed simultaneously by a competent developer.

Output

A competent developer should be able to develop a thorough diagnosis and to demonstrate substantial improvements in pre-interim and post-instructional instructor behavior in the four to eight-week period. Moderate gains in development skills, such as writing behavioral objectives, task analysis, planning instructional strategies and conducting product or instructional evaluations can be realized in faculty seminars.

The most basic unit of output in either of the major strategies is a validated unit of instruction. The proposition holds whether the developer or the faculty member develops the instruction. A validated unit may vary from one hour to several weeks of student contact hours. In such a unit, approximately 90% of the students may be expected to master approximately 90% of the objectives in a reasonable length of time.

The Diffusion/Adoption Function

ALICE JWAIDEH, INDIANA UNIVERSITY

INTRODUCTION

Diffusion is the process through which a new product or practice becomes accepted and implemented, that is, "adopted" by an individual, a group or a system. The three basic functions involved in diffusion are: (1) dissemination, (2) demonstration and (3) facilitating adoption. Special competencies are required to perform these roles effectively, and the purpose of diffusion specialists or "change specialists" is to provide these kinds of skills for university Technological Communications Services.

The diffusion process differs in many ways from the processes of development and production and usually increases in intensity as these other processes near their culmination. After a product or innovation has been invented or designed and, in some cases, systematized into an innovative package suitable for use, further activities are needed to gain its acceptance and adoption. The most effective solutions to practical problems can be ineffective unless they are diffused to the level of the practitioner and adopted by him.

In his well-known report entitled *Organizing New York State for Educational Change*, Henry Brickell emphasizes the importance of recognizing the distinctions between development (which he calls "design") and diffusion. He points out that these processes require different conditions for success and that often the people who work well in one phase may not work as well in the other (p. 71). The main reason why such fields as agriculture and industry have made such rapid progress in improving their methods, according to Brickell, is that they have recognized the differences between these stages in the change process and have provided the special circumstances and training needed for each.

DEFINITIONS OF SPECIAL TERMS

The *dissemination* aspect of diffusion involves spreading awareness among practitioners of the existence and general nature of an innovation. It also involves arousing interest in the innovation. This task goes beyond merely imparting information. It involves the affective domain, for the diffuser must create a desire for the change, provide encouragement, and, if possible, arouse genuine enthusiasm on the part of potential users.

Through the *demonstration* function, the diffusion specialist gives practitioners an opportunity to examine and assess the operating characteristics of the innovation and build conviction concerning its suitability and effectiveness for them. The demonstration should provide a real chance for practitioners to gain experience with the innovation in a setting similar to that in which they would use it.

Facilitating adoption involves helping the adopter to incorporate the innovation into the functioning system and providing the necessary assistance and support for maintaining it. This involves consideration of such factors as providing the necessary funds, materials and equipment required by the innovation, adapting it to meet specific needs, training personnel in its use, establishing reward systems for its use and providing for continuing evaluation of its effectiveness.

RATIONALE

Personnel and Competencies

Every institution of higher learning which intends to keep abreast of new technological and other developments that will help improve its programs should have at least one diffusion specialist. It would be desirable, if possible, to have additional supporting personnel. Personnel requirements will, of course, be determined by the size of the institution and the demand for diffusion/adoption services.

The specific activities to be performed by diffusion specialists differ somewhat, depending upon the particular positions they hold. Thus, in different situations, there may be relatively more or less emphasis on aspects of diffusion involving the roles of information conveyor, demonstrator, promoter, trainer or consultant. The professional in this area can direct, carry out and/or provide expert advice concerning a number of kinds of activities which could benefit not only the Technological Communication Services program but any department or program in the institution. He might, for example:

- plan and carry out a change campaign of any kind
- serve as a consultant on the process of change
- assist in installing an innovation
- arrange for widespread publicity concerning the availability of new technological equipment
- promote the use of a new package developed by the instructional development staff
- serve as a resource person to answer inquiries concerning new developments of various kinds
- put persons in touch with outside resources needed by them
- set up a "temporary system" for implementing a basic change in the institution's organization
- obtain faculty reaction and feedback concerning a proposed change
- help plan and conduct workshops or other forms of in-service training.

In nearly all cases, the job of the diffuser is to link or bring together the improved products, materials and practices—that is, the innovations—with the practitioners who might benefit from their use. He accomplishes this through the three basic functions mentioned above—dissemination, demonstration and facilitating adoption.

Performing diffusion functions requires a combination of various skills and competencies. Ideally, the specialist in this area must be familiar with new educational technology and materials and with methods of integrating them into an instructional program. He should understand the techniques and media of communication and attitude change, so that he can successfully overcome resistance to change. He should have an understanding of diffusion models, strategies and techniques. His job also calls for human relation's skills, for he must be able to deal effectively with individuals and groups. Finally, he should have an understanding of the educational institution as a social system and of its relationship to the community. In addition to these broad understandings and competencies, he should have the following specific skills essential to the diffusion process.*

Dissemination

- Defining and analyzing characteristics of potential adopters.
- Selecting from available information about developed innovations that which can be most effectively disseminated.

*This list of diffusion skills was developed by a special committee appointed by the American Educational Research Association to analyze the process of change in education.

- Selecting the most effective dissemination vehicles to convey information to specific audiences.
- Composing the information, within a chosen format, for accurate and pervasive dissemination.
- Implementing actual dissemination, including the direction of technical production personnel.
- Designing and implementing techniques for evaluating the effectiveness of the dissemination effort.

Demonstration

- Specifying the nature of the demonstration.
- Selecting appropriate setting and personnel for the demonstration.
- Managing and coordinating the demonstration effort.
- Evaluating the effectiveness of the demonstration.

Facilitating Adoption

- Identifying features of the adopting organization or system which differ from those in which the product was developed and tested.
- Designing modifications of the product to fit the adopting organization or system, when necessary.
- Designing procedures for modifying the adopting system or organization to fit the product, when necessary, including the design of needed training programs.
- Identifying and overcoming potential barriers to implementation.
- Devising and conducting long-range evaluation of the installed innovation's effectiveness in the adopting system.

Organizational Pattern

The diffusion staff or diffusion specialist should operate at an organizational level which would facilitate effective functioning as a promoter of change. In most cases it would be desirable for the diffuser to work closely with the instructional development and consultant services personnel. It is important that close contact be maintained between the diffusion personnel and the administration of the Technological Communication Services.

QUANTIFICATIONS

As indicated above, at a minimum level, a university should have at least one diffusion specialist for Technological Communications Services. At a more advanced level, a large institution or program might utilize a staff of several assistants and one or more secretaries under the supervision of a full-time diffusion expert.

The facility should be located so that it is easily accessible to all parts of the university system. As in the case of the staff, the size of the facility will depend upon the size, resources and needs of the institution being served. At a minimum level, an office with necessary communication equipment for the use of the diffusion specialist would be required. At an advanced level, the facility should include an office for the professional in charge of the diffusion program and his assistants, a conference room and other space as determined by the size of the staff. There should be a substantial array of communications equipment, including both equipment to be used by the diffusion staff and examples of the new technological products they will be diffusing (e.g., overhead projectors, bulletin boards, display cabinets, examples of transparencies, filmstrips and other software, portable campaign devices, videotape recorders etc.) For the use of the diffusion staff, there should be duplicating equipment, telephones and access to rapid courier services in order to facilitate intra-campus communications and to enable the staff to keep in touch with outside agencies and information sources.

The budget should be adequate to cover the following categories of expenses:

Personnel: Salaries of professional diffusion specialist(s), assistants and other support personnel (writers, artists, secretaries etc.).

Production: Printing and graphic services (for brochures, posters etc.).

Travel: Transportation expenses of diffusion staff, faculty and other clients and consultants.

Communications: Postage, telephones, courier services etc.

Materials and equipment: See above.

The Production Function

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INTRODUCTION

Many necessary instructional materials are not available in usable form from commercial sources, so they must be produced or adapted locally. To meet this need, technical personnel of the college or university media center work in consultation with clients and with instructional development staff to produce media that have been requested directly by official users, or media for which the nature and need have been determined by a systematic process of instructional development.

Media production facilities and services in higher education primarily serve four groups of clients: (1) faculty members—for classroom presentation or individualized instruction and in support of research and scholarly publication; (2) students—for course projects and extracurricular activities; (3) media center personnel—for faculty development workshops, inservice training and technical research; and (4) administrators, counselors and public relations staff—for presentations both on and off campus, i.e. budget, public information, recruiting and employee training. Despite the variety of users and uses, a survey of representative media production centers indicated that from 75% to 85% of the workload of the media production services unit was, and should be, attributable directly to support of instruction.¹

Although the support and improvement of instruction is the main reason for providing media production services, the typical college or university professor has not often been a regular customer of the media center. When media production services have been used, the faculty member's needs have most often been satisfied at what Kemp² has described as the *mechanical preparation* level (Level 1). Included at this fundamental, or basic level are such functions as the routine mounting or laminating of pictures and charts, the duplicating of prepared handout materials by spirit, stencil or offset processes, or the copying "as is" of illustrations from books and other sources as slides and transparencies. In other words, the mechanical preparation level (Level 1) involves local production of audiovisual "aids" at the request of the user with no questions asked and little advice given. According to the survey mentioned above, approximately 75% to 90% of media production in higher education is presently at this level.³

Relatively few professors on the average campus request services at Kemp's definition of the *creative production* level (Level 2) at which tactical decisions are made by the producer, in consultation with the faculty user, about content, treatment and format of tailor-made media such as teaching displays, sound/slide series or instructional films or videocassettes. Consequently, most college and university media centers tend mainly to employ

¹Unpublished survey by David H. Curl 1972-74.

²Kemp, Jerrold E. *Planning & Producing Audiovisual Materials*, 2nd ed. Chandler Publishing Company, San Francisco, CA, 1968.

³Curl, op.cit.

students and technician-level production personnel in considerably greater numbers than media consultants with graduate degrees. Level 2 implies media planned and produced in units or modules to fit a professor's general objectives.

The stress of instructional development has shifted the focus from media as end products in themselves to media as a means toward achievement of specified performance objectives. Therefore, as the production function overlaps into the domains of development and diffusion/adoption (see Fig. 1, page 13, Instructional Development) production personnel and facilities must be sophisticated enough to support higher-level quality demands, increased workloads and prolonged professional responsibilities at Kemp's strategic, client- and objectives-centered *conceptual design* level (Level 3). This highest level can be expected to become the focus of media production activities in the decade to come. Level 3 is the level of full instructional development at which media are planned, produced, tested and carefully integrated into instructional programs based upon performance objectives.

Although routine "walk-in" graphic, audio, photographic and reproduction services must be maintained by the media center for users who will continue to require these services, the following guidelines and discussion are based upon the premise that the major orientation of the media production function in higher education should be toward achieving the capability to perform services at Level 3.

A HYPOTHETICAL MEDIA PRODUCTION CENTER

For purposes of this publication we shall consider the following areas of production: (1) administration and supervision, (2) audio production, (3) graphic production, (4) photography, both still and motion picture, and (5) printing and duplicating.

Survey data led to the development of the chart on the next page which indicates the relationships of these services to each other and to the total media center in a hypothetical organizational chart. According to the estimates of survey respondents, such an organization would be capable of providing media production services up to and including Level 3 for a college or university of approximately 10,000 Full Time Equivalent (FTE) enrollment.⁴ Note that television, as a part of the telecommunications functions, is shown separately on the chart, precedent seeming to have established telecommunications in this way on many campuses. A unique area combining both production and distribution functions, telecommunications draws upon the combined talents of instructional development, production and utilization personnel. Motion picture production as well as some audio and graphic functions will be included within telecommunications at many institutions. Likewise, printing and duplicating services are often centralized in a print shop separate from media services. Our chart, however, reflects a consensus of needed production functions as well as a common organizational structure.

The survey included the editorial and programming areas, but in tabulating data from various colleges and universities it was difficult to separate editorial, scripting and program writing functions from instructional development functions. At institutions where an instructional development unit was not identified, personnel performing these functions were often housed within the production services unit. For purposes of present guidelines, writers, editors and programmers are classified as instructional developers and their activities do not appear under production services.

Personnel

Associate Director for Production Services

Nature of Work—Serves as liaison between instructional developers and other users of production services and the technical personnel under his direction; responsible for the

⁴Curl, op cit.

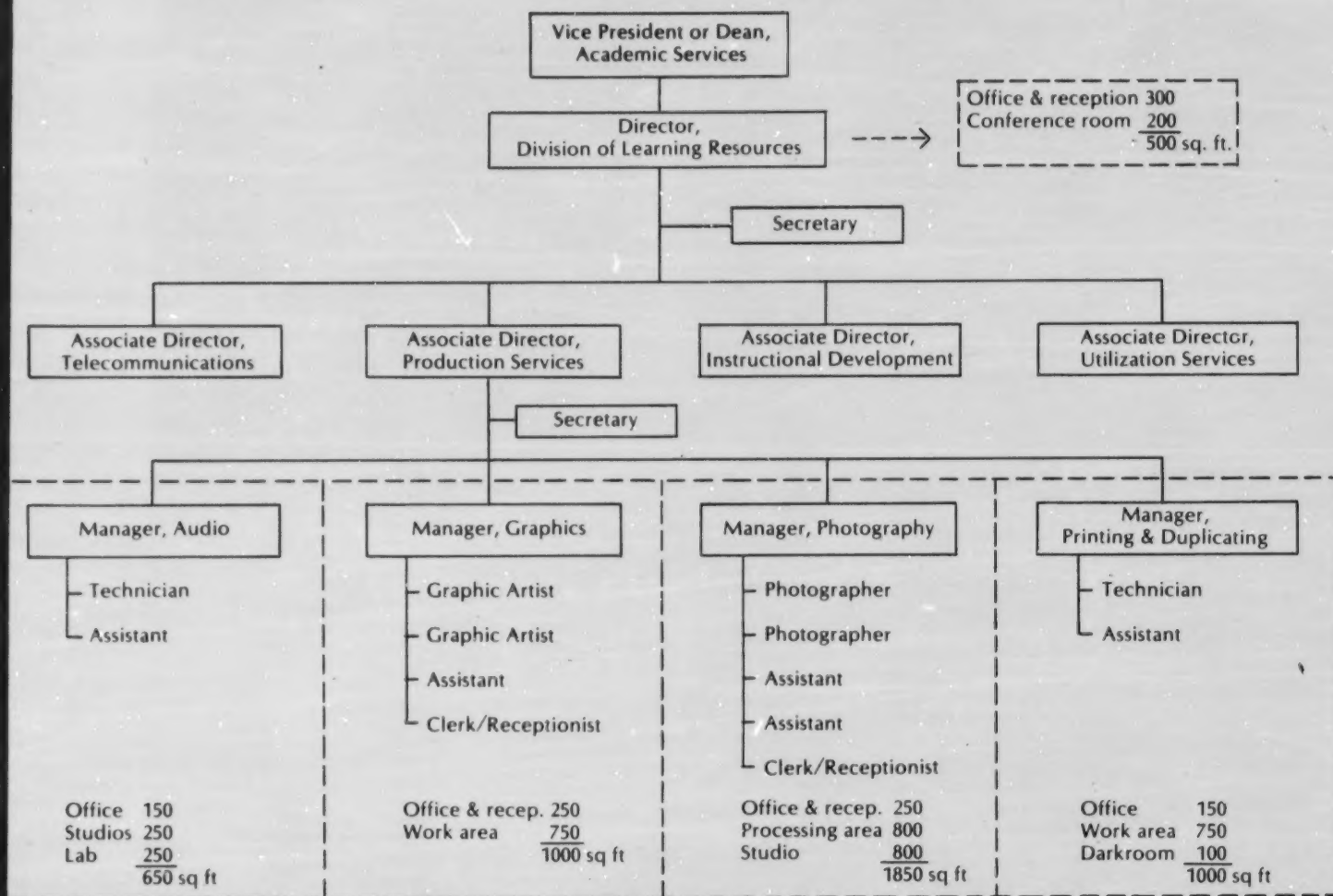


Figure 1

management and overall supervision of audio, graphic, photographic and reproduction services.

Examples of Work—Establishes production services goals, plans production schedules and monitors production activities; consults with faculty, instructional developers, and other users on the design, production and evaluation of instructional media; establishes and sustains quality control standards; maintains accurate records of departmental income and operating costs; specifies purchase and maintenance of major equipment; interviews, evaluates and provides training for production personnel; participates in the planning and presentation of courses, workshops and inservice programs for faculty and students.

Qualifications—Minimum of MA (doctorate preferred in larger universities) with teaching experience in higher education; experience in media production mandatory; technical expertise highly desirable.

Number of Positions—One per institution or campus. At colleges with enrollment less than 1,000 FTE, functions of this position may be combined with those of the Director of Instructional Communications.

Manager, Audio

Nature of Work—Consults with clients on audio and acoustical problems and supervises work of technical personnel.

Examples of Work—Provides professional consultation to faculty, students and other clients regarding audio presentations and acoustical treatment of facilities; coordinates and supervises the work of audio technicians and other personnel; trains audio personnel and evaluates their performance; maintains quality control standards; maintains stocks of supplies and recommends purchase of equipment and supplies; maintains production records; assists with courses, workshops and inservice programs for faculty and students; scripts, records, dubs, edits and mixes audio programs and operates equipment.

Qualifications—BA or MA with experience in electronics and commercial audio or broadcasting. Technical competence mandatory.

Number of Positions—One per institution or campus. At a college with enrollment of less than 1,000 FTE, this individual may be required to perform all technical functions and to supervise student assistants.

Audio Technician

Nature of Work—Prepares sound recordings for instruction and operates and maintains audio equipment; must be capable of working independently on assignments with only general supervision.

Examples of Work—Records narration, dialog and performances; edits, dubs and mixes audio tracks; makes tape duplicates for instruction; installs and maintains recording, public address and sound reinforcing systems; supervises work of student assistants.

Qualifications—BA desirable; electronics and audio experience mandatory.

Number of Positions—One per 10,000 FTE enrollment. Some duties may be shared with personnel in telecommunications area.

Manager, Graphics

Nature of Work—Consults with clients on graphic design and production and supervises work of technical personnel.

Examples of Work—Provides professional consultation concerning creative applications of graphic design for faculty, students and other clients on technical and esthetic problems relating to production of artwork for instruction, display and publication; prepares preliminary sketches, outlines and publication dummies; coordinates and supervises the work of

graphic artists, draftsmen and other personnel; trains graphics personnel and evaluates their performance; maintains quality control and esthetic standards; maintains stocks of supplies and recommends purchase of equipment and supplies; maintains production records; assists with courses, workshops and inservice programs for faculty and students; plans, designs and produces graphic materials.

Qualifications—BA, BFA, MA or MFA with experience in commercial art; must show evidence of competence in all aspects of graphic production.

Number of Positions—One per institution or campus. At a college with enrollment less than 1,000 FTE, this individual may be required to do mainly design and production work and to supervise student assistants.

Graphic Artist

Nature of Work—Prepares artwork for non-projected charts and displays and for transparencies, slides, filmstrips, motion picture titles and animation, and television graphics; must be capable of working independently on assignments with only general supervision.

Examples of Work—Works from sketches to render finished artwork for charts and displays and for projected media; prepares lettering for visual media; operates equipment such as typesetting and transparency making machines and vertical process camera; performs routine maintenance on equipment; supervises work of student assistants.

Qualifications—BA or BFA desirable; commercial art experience mandatory.

Number of Positions—One per 5,000 FTE enrollment. Additional artists or draftsmen will be required at institutions doing engineering drafting or a large volume of publications and publicity work.

Manager, Photography

Nature of Work—Consults with clients on photographic problems and supervises work of technical personnel.

Examples of Work—Provides professional consultation for faculty, students and other clients on solutions to technical and esthetic problems pertaining to still and motion picture photography; coordinates and supervises the work of photographers and other technicians; prepares storyboard and shooting script when not provided by client; trains photographic personnel and evaluates their performance; maintains quality control standards; requisitions supplies, laboratory services and equipment; maintains production records; develops accountability system and maintains security for facilities, equipment and supplies; assists with courses, workshops and inservice programs for faculty and students; performs any task assigned to a photographer or technician.

Qualifications—BA, BFA, MA or MFA with professional photographic experience; must show evidence of competence in all areas of photography.

Number of Positions—One per institution or campus. At a college with enrollment of less than 1,000 FTE, this individual may be required to perform all photographic assignments himself and to supervise student assistants.

Photographer

Nature of Work—Produces a wide variety of still photographs and short motion pictures largely for instructional purposes; must be capable of working independently on assignments with only general supervision.

Examples of Work—Photographs activities, projects, displays, buildings, scenes and other illustrative subject matter in 35mm color slides and in black and white and color

negatives; makes line and continuous-tone copies and macro photographs in black and white and color; operates 35mm, 2 1/4 and 4 x 5 still cameras and 16mm and super 8 motion picture cameras and accessories; processes and prints black and white and color roll and sheet films and produces black and white and color prints and slides; scripts, shoots, edits and assists with sound recording for instructional motion pictures and film segments, slide/tape programs, filmstrips and multi-image productions; performs routine maintenance of equipment; supervises work of student assistants.

Qualifications—BA or BFA desirable; varied professional photographic experience mandatory.

Number of Positions—One per 5,000 FTE enrollment. Additional photographers or technicians will be required at institutions requiring specialized photographic services such as photomicrography, photo-instrumentation and when public relations photography, portraits and identification pictures and athletic films are produced in the media services unit. Some large universities having a separate film production unit may include instructional motion pictures and television film as responsibilities of that department.

Manager, Printing and Duplicating

Nature of Work—Consults with clients on printing and duplicating needs related to instruction; supervises work of technical personnel.

Examples of Work—Provides professional consultation to faculty, students and other clients concerning appropriate reproduction processes; coordinates and supervises the work of duplicator operators and other technical personnel; trains personnel and evaluates their performance; maintains quality control standards; maintains stocks of supplies and recommends purchase of equipment and supplies; maintains production records; assists with courses, workshops and inservice programs for faculty and students; operates equipment to meet all duplicating and reproduction requirements.

Qualifications—BA desirable; technical experience in commercial duplicating and printing mandatory.

Number of Positions—One per institution or campus. At a college with enrollment of less than 1,000 FTE, this individual may be required to perform all technical functions and to supervise student assistants. (This position may not exist within some universities having established printing departments. Where a strong centralized printing facility exists, the supervisor of graphics will probably be the liaison person responsible for carrying through on reproduction projects. In such cases the Division of Technological Communications may not include a printing and duplicating function).

Printing and Duplicating Technician

Nature of Work—Produces finished booklets, brochures, handout sheets etc. from copy prepared by graphic and photographic personnel and clients.

Examples of Work—Prepares line and halftone negatives from camera-ready copy; makes plates for offset printing; operates offset duplicators and presses; collates, trims, stitches and/or ring binds finished materials; performs routine maintenance on equipment; supervises work of student assistants.

Qualifications—Vocational training and experience mandatory.

Number of Positions—One per 10,000 FTE enrollment. Additional technicians will be needed at institutions not providing general printing services. At some institutions all printing and duplicating will be done by the centralized printing department and these services need not be provided by the Division of Instructional Communication.

Summary

Figure 1 provides a model media production services organization that can be expanded or reduced according to the size and special requirements of each college or university. The suggested job descriptions are representative of actual positions found at the institutions surveyed and space recommendations are indicative of what should be considered the minimum amount of space needed to serve a small to medium sized campus.

PRODUCTION POLICIES

In conclusion, it seems appropriate to review some areas of production policy that have frequently caused confusion and conflict on campuses.

Copyright

In local reproduction of materials for instructional or other public use, care should be taken to secure permission in accordance with copyright regulations.

Proprietary Rights

It is ordinarily assumed that all rights to materials produced by a faculty member or employee as a part of his regular job belong to the institution, unless contracted otherwise. Likewise, it may be expected that rights belong to the individual employee when materials are produced on his own time and without the use of materials, equipment or facilities belonging to the institution. It is important, however, that policies be established by which specific cases may be judged.

Residual Rights

Policies should be determined to protect the rights of faculty and staff members when locally produced materials they have produced, authored or participated in are published or used beyond the purpose for which they were originally intended. The individuals affected should participate in decisions regarding such additional uses and agreement should be reached regarding royalties or other compensation.

Teaching vs. Production

Efficiency and quality demand full-time professional producers, photographers, graphic artists and technicians; but when teaching is also involved, conflicts of interest can arise. When an individual reports to more than one supervisor and is expected to allocate his time equitably between different spheres of responsibility, the quality of either the teaching or the production has been known to deteriorate. Definite policy guidelines are important in such cases, especially when individuals hold dual academic and technical or administrative appointments.

Student Help

Students can learn a great deal by working in the media production center—this is, in fact, the way most professionals in the field got their start. But because of the high turnover each year, students require considerably more time to train than permanent personnel. A good rule is to employ a full-time cadre of professionals in key positions, then supplement the work of these key individuals by assigning students initially to jobs requiring a minimum of experience. The more able students may then be rotated into more responsible jobs as they return in subsequent years.

Charging for Services

Some institutions underwrite budgetary support to the media center so that all production services for instructional and related purposes can be provided free of charge. Other

media centers are forced to charge individual users or users' departmental budgets either a fixed "catalog" price or to invoice for time and materials or for materials only. Differential rates are often established, charging less for materials to be used for instruction and more for materials intended for other purposes. Free services encourage the use of media, of course, and reduce the amount of bookkeeping and billing required of the media center. Regardless of institutional requirements, charging and billing policies should be established, published and uniformly adhered to.

Research and Publication

Policies should be established to determine whether or not materials will be produced or duplicated by the media center for individuals, i.e. students working on theses or class projects or faculty members documenting research projects or preparing manuscripts for outside publication. If such work is done, it must be determined whether full charges will be assessed or whether the individual pays only for expendable materials consumed.

Do-It-Yourself

Teaching basic production skills to faculty members, students and employees of other departments encourages them to make and use more audiovisual materials. But at the same time, instruction and consulting advice encourage other departments to establish their own media production facilities that often duplicate those of the media center. High-level policy decisions are necessary on the question of centralization vs. decentralization of production facilities, equipment and personnel. Perhaps an ideal compromise reached on some campuses is to establish centralized control of media production, including purchasing of equipment and supplies, while providing satellite centers in key areas on campus to serve clients most conveniently.

Personal Work

A frequently stated policy is that employees of the media center may use institutional equipment and facilities after work hours for personal production work of a non-commercial nature. Wedding photographs or portraits for sale would be prohibited, for example, but photographs for exhibition in an art show would be permitted—even encouraged—as evidence of professional growth of the individual. Specific policies should be formulated to cover production of items that may compete with private industry such as political campaign posters and literature, church programs, club newsletters and personnel stationery and greeting cards. If such projects are allowed, in no case should expendable materials be used that have not been supplied or reimbursed by the individuals concerned.

CAPITAL EQUIPMENT

Our survey of college and university media production centers revealed the following items as representative of major equipment needed to meet estimated minimum needs at levels 2 and 3. Certain items will not be required at all centers; for instance on campuses where all printing is centrally done, none of the printing and duplicating equipment listed will be applicable to the media services center. Motion picture production equipment may not be needed at institutions served by a separate telecommunications facility. Only the largest or most remote campuses will be able to justify the expense of purchasing and maintaining automatic continuous photographic processing machines; but in cases where the workload requires, such equipment is desirable indeed.

In many instances, at least one of a given item will be required to meet minimum service needs, regardless of the size of the institution. From an analysis of equipment owned

by existing media production centers we have attempted to provide quantification guidelines that will provide an intelligent departure point for estimating the needs of a given college or campus. Note that these items are housed and used in the media production center. This list does not include equipment housed in the general equipment pool and available for use by other departments and by students as part of regular classroom instruction.

<i>Items</i>	<i>Quantity</i>
Airbrush and compressor	1 per institution or campus
Binding machine, plastic ring	1 per institution or campus
Camera, animation—slide, filmstrip and motion picture	1 per institution or campus
Camera, 35mm single-lens reflex	1 per photographer + 2 spares
Camera, 35mm half-frame filmstrip	1 per institution or campus
Camera, 2 1/4 reflex	1 per photographer
Camera, 4x5 view	1 per institution or campus
Camera, photostat	1 per institution or campus
Camera, Polaroid	2 per institution or campus
Camera, copy, Polaroid and 4x5	1 per institution or campus
Camera, process copy, up to 11x14	1 per institution or campus
Camera, motion picture, super 8	2 per institution or campus
Camera, motion picture, 16mm silent	1 per institution or campus
Camera, motion picture, 16mm sound	1 per institution or campus
Coater, wax	1 per institution or campus
Collator	1 per institution or campus
Composer, type, photo/optical	1 per institution or campus
Console, mixing, audio studio	1 per 10,000 FTE
Copier, office type	1 per 5,000 FTE
Dissolve unit, 2x2 slide projector	3 per 10,000 FTE
Duplicator, cassette tape	1 per 10,000 FTE
Duplicator slave, cassette tape	1 per 2,000 FTE
Duplicator, 1/4" tape	1 per institution or campus
Duplicator, offset, up to 11 x 17	1 per 5,000 FTE
Duplicator, electrostatic (Xerox)	1 per 10,000 FTE
Duplicator, mimeograph stencil	1 per 10,000 FTE
Duplicator, spirit master	1 per 10,000 FTE
Duplicator, slide and filmstrip	1 per 10,000 FTE
Drill, paper	1 per institution or campus
Dryer, continuous, photo print	1 per institution or campus
Editor, motion picture, super 8	1 per 10,000 FTE
Editor, motion picture, 16mm silent	1 per institution or campus
Editor, motion picture, 16mm sound	1 per institution or campus
Enlarger, photo, up to 2 1/4	1 per photographer
Enlarger, photo, color head, 4 x 5	1 per institution or campus
Jogger	1 per institution or campus
Laminator, continuous roll	1 per institution or campus
Lights, photo studio	12 per 10,000 FTE
Microphone, studio	5 per 5,000 FTE
Mixer, audio, portable	1 per 5,000 FTE
Mounter/cutter, 35mm slide	1 per institution or campus
Platemaker, offset, automatic	1 per institution or campus

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Press, dry mounting	2 per 10,000 FTE
Press, printing, proof and sign	1 per institution or campus
Press, titling, "hot" type	1 per institution or campus (optional)
Processor, continuous, b & w roll film	1 per institution or campus (optional)
Processor, continuous, color roll film	1 per institution or campus (optional)
Processor, continuous, color print	1 per institution or campus (optional)
Processor, continuous, motion picture film	1 per institution or campus (optional)
Processor, drum, color print	1 per institution or campus
Processor, stabilization, b & w print	1 per institution or campus
Projector, motion picture, super 8 mag. sound	1 per institution or campus
Projector, motion picture, 16mm optical/mag. sd.	1 per institution or campus
Projector, motion picture, 16mm, interlock	1 per institution or campus (optional)
Projector, opaque, enlarging/reducing	1 per institution or campus
Projector, overhead transparency	1 per institution or campus
Projector, filmstrip	1 per institution or campus
Projector, automatic, 2x2 slide	8 per 10,000 FTE
Programmer, multi-channel, 2x2 slide	1 per 10,000 FTE
Punch, cel, animation	1 per institution or campus
Punch, binding, plastic ring	1 per institution or campus
Recorder, audio cassette	1 per 5,000 FTE
Recorder, audio cassette synchronizer	1 per 5,000 FTE
Recorder, audio, 1/4" tape, studio master	2 per 10,000 FTE
Recorder, audio, 1/4" tape, portable	1 per 5,000 FTE
Recorder, audio, 1/4" tape, magnetic synch.	1 per institution or campus (optional)
Recorder, magnetic film, 16mm, synch.	1 per institution or campus (optional)
Saw, table or radial arm	1 per institution or campus
Saw, jig	1 per institution or campus
Stand, copy, still photo and super 8	1 per 10,000 FTE
Speaker, monitor, studio	4 per 10,000 FTE
Stitcher	1 per institution or campus
Sign-maker, embossed letter	1 per institution or campus
Table, illuminated, viewing and stripping	1 per 5,000 FTE
Table, drafting	1 per graphic artist
Transparency maker, thermographic	1 per 10,000 FTE
Transparency maker, diazo	1 per 10,000 FTE
Trimmer, paper, guillotine	1 per institution or campus
Typewriter, electric, office	1 per office
Typewriter, large-type	1 per 10,000 FTE
Washer, photo print, to 20 x 24	1 per institution or campus

The Telecommunication Function

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INTRODUCTION

Communication is a major process in education and social interaction. This process is a circular, ongoing transference of messages between sources. The experience of the sender and the receiver affects the shape and meaning of the message. What a communicator brings to the situation from past experience determines to a large degree the effectiveness of the communication. There must be some congruency of experience between the sender and the receiver or the message will get through but the meaning will not. The shape of the message is couched in a mixture of three domains: the cognitive (intellectual), the affective (emotional) and the psychomotor (physical).

Whenever message transmission is conducted, all domains of learning are present at some level. A television lecture may have current and precise information and yet the meaning of the message will be blocked because only the intellectual aspect is taken into consideration while emotional and physical aspects of production are ignored.

The transference of meaning is limited by the senses. We cannot read people's minds; we can only shape meaning within the constraints of the senses. Sensory and perceptual aspects, which have received much study, are also considerations which need further research, particularly in terms of the communications process as it relates to television.

A bi-sensory channel for communications as well as a practical medium for learning, television remains viable, having much potential, and should be a highly prized resource. The use and misuse of television have left a wide variety of attitudes concerning its place in education. Its technological compatibility, expense, the need for trained specialists and the all-consuming production capacity make this medium a difficult one. Technical, electronic problems in television are probably the easiest to work out. A wide variety of equipment is now available in both black-and-white and color, ranging from inexpensive equipment available for the novice through various levels of sophistication to professional equipment requiring trained technical personnel.

A commitment to producing television programs on a campus means there must be enough resources available to consistently do an adequate job. The medium of television can be considered a monster which is constantly consuming ideas, talent and materials. Once each production is completed, all the resources are scrapped and another production must be assembled. Until the present easy access to video tapes, each production was presented and then it was over. The total production existed for a moment and then was gone, making every production ephemeral, unlike hard copy which one can review, study, compare, skim and ponder. With videotape, a more permanent product is possible in terms of having the production accessible to faculty and students. This helps alleviate the problem of the all-consuming monster to some extent, but the possibility of storage and retrieval of successful productions should be explored. Depositories for videotapes are being implemented both on campuses and regionally, but not to the extent that films are now available. The transfer of

videotapes to film is a possibility itself for effective and easy handling, but even so, the establishment of depositories, using good storage and retrieval, will help conserve production resources.

Educational television and instructional television have great potential. Educational television—the programming of materials for the generalized public of all ages—is found mostly in broadcast television. Lately it has expanded through cable television and videotapes available through public libraries. Considerable expansion is still possible. With the development of community antenna systems and closed-circuit networks, more channels are available for home viewers to select as prime vehicles for educational television.

Instructional television—that programming which is designed with specific objectives for particular populations—is moving more towards closed-circuit and portable television. All too often, instructional television has been used for promoting and preserving lectures. This style of production has been deadening to the status of instructional television. Students cannot accept such programming.

Due to the learning characteristics of students and the complexity involved in good communications, as well as the slick productions available on commercial television, instructional television must be produced in ways more appropriate to the medium of television (the talking face is out!). If instructional television is to be used to its best advantages, then the visual work must be produced with a high percentage of images that have a message. Many graphics and a wide variety of visuals are needed in any instructional television production. The visual image must either support the verbal material or be so specific that the meaning in the message is evident when viewed.

Learners of our contemporary age are sophisticated television viewers and, thus, expect such aspects of television as: variety that does not lose consistency; action which avoids busy sequences; the use of color; shots which have been established with much close work; short, concise presentations; humor which avoids the ridiculous, and the personal approach. Learners will accept some poor technical qualities if the production quality contains these aspects. Learning is best facilitated when it is specific to the point of requiring active involvement resulting from the presentation. Instructional television can be motivating at the affective level.

PROBLEM AREAS

Some material is not appropriate for television. For example, television is a poor medium for conveying the printed word. It is very difficult to see sentences and paragraphs on television; only phrases and titles work well. When charts, maps and graphs are used, an overall view of the material does not convey the message clearly. The meaning can be better derived by focusing the viewer's attention on that particular portion of the visual the instructor is highlighting. Productions are moving more toward tight, close shots that afford more efficient study of materials.

Since the verbal material in the audio portion is usually needed to convey much of the cognitive material, the sound production needs to be given precise attention. All too often in portable television work in the classroom the microphone picks up reverberated sounds rather than direct sound from the source. The difficulty in understanding the playback form is extreme. Closer placement of microphones and the use of directional microphones need to be encouraged. Often one needs to correct the problem only by using an extension cord. In studio work it is usually corrected by using a lavalier microphone.

STUDIO TELEVISION

Studio television is advantageous for campuses for several reasons:

- While the on-campus, closed-circuit system is the most difficult area to deal with for instruction, other applications can be managed through the closed-circuit system, such

as in-service work for faculty; sports events; testing, and special events, including graduation, convocations and public addresses.

- A second function of a studio facility is the production of videotapes, such as tapes for portable classroom equipment and other studio playback facilities. These tapes are produced as a service to faculty and are often produced in cooperation with faculty members. Studio-produced tapes can be used at the convenience of each faculty member and the material on the tape can be more closely designed to accommodate specific needs.
- Studio productions are usually slicker than portable productions. Multiple cameras with their various advantages of superimposition, split screens and other special effects can be highly utilized. Tighter, better focused shots can be obtained.

Studio production is more impersonal than portable classroom production, since classes or audiences are usually not available. To compensate for this, there has been a trend toward requiring on-time or off-time student involvement in activities related to the program. It is difficult to find personalities who can successfully handle this type of environment. Studio talent need to have knowledge of their subject and of teaching, as well as that personal quality which is captivating to the audience.

Studio television, both broadcast and closed-circuit, can range widely in complexity, from one professional using student operators, to complete facilities and a staff of administrators, engineers, production workers and on-camera personnel. Established controlled viewing areas and equipment which is permanently set and which usually has the capabilities of doing something more than a single camera and video recorder can are indicative of studio television. Lighting and sound capabilities are usually better controlled. Multiple camera hook-ups are installed. Some cameras are controlled remotely from a console and others are operated by camera personnel.

PERSONNEL

The professional staff of a studio should include people with training and experience in administration, electronics, television production and teaching. Small facilities will need to employ persons with two or more of these talents in order to produce quality programs within their budget.

Administration

Administration requires knowledge of budget planning, public relations, overseeing of personnel and general knowledge of educational processes. The administrator needs to be given a prominent position, so as not to be swayed or pressured by any one person or group. In some cases this will require his being placed with the vice-president and in others it will require placement with a strong media director. Administrative freedom is needed so that the administrator will not get caught up in serving a few needs on campus to the exclusion of others.

Technical

Technical personnel are needed for the smooth operation and maintenance of equipment. In sophisticated systems people with engineering licenses are needed. With less sophisticated systems, a technical worker should have sufficient training in preventive maintenance in order to troubleshoot problems with equipment before complete breakdowns occur. He should have access to and be able to use several pieces of test equipment. A moderate amount of benchwork should be part of this training. This person should be able to adapt to changing equipment and facilities. He should be versatile in order to obtain the best possible quality control on the final product, while being able to work with facilities which might be considered inadequate.

Production

Production personnel must be proficient in grades, staging, sound and acoustics, lighting, photography, camera operations and the use of make-shift props. They need to be creative and inventive and able to perceive the product desired by the instructor or director who is organizing the production. In all cases personnel with teaching experience or training can be of great help in producing effective instructional television.

Talent

Talent for studio television must have knowledge of the subject, rapport with the viewers and flexibility. Knowing one's subject insures confident presentations, both verbally and visually. The best visuals can then be chosen in terms of the meaning which is to be conveyed. Together, the television staff and performers can design the most creative approaches and combinations for the visuals.

Rapport between the talent and the viewers is accomplished through previous contacts, plain talking during the presentation and the use of humor. If these three factors are positive, the chances of relating to the viewers can be increased.

Because television is a one-way device for communications, establishing rapport is not as easy as in a two-way interchange. Assessing the effectiveness of the presentation is a delayed function requiring many hours or days. It is difficult to have good presentations with performers who do not project well on television. However, it is difficult to detect good or bad talent on camera until auditions have taken place or until several presentations have been viewed. An unresolved problem is what to do with the expert who is the only one who knows the subject but who does not come across well on camera. Many attempts have been made to substitute talent, to use parts of the expert's presentation and compensate with a heavy overlay of visuals, or to resort to actors. None of these methods has been found to be very successful.

Talent must be able to work under pressure. This entails flexibility concerning time constraints, equipment failures, staff personalities and unsatisfactory visuals.

EQUIPMENT

Two variations of the studio control room style are mobile units and permanently stationed equipment in large lecture rooms which is usually instructor-operated. Mobile units most often consist of a van that is completely outfitted as a studio with recording equipment and monitors and cameras for video work—both outdoors and in buildings not otherwise arranged for television. Some vans record on location with tape decks; others transmit a signal via broadcast channels to the parent studio.

Lecture halls can be equipped with either single or multiple-camera arrangements. Sometimes tape decks are connected so that this direct-teaching on television can be implemented at other times and places.

To facilitate viewing by the learners, multiple monitors are distributed throughout the main lecture hall. Sometimes other lecture halls are connected to the same facilities in order to expand the coverage of the television lesson.

A fast-growing area is portable classroom television. The equipment is easily carried or moved around by carts and is available for use by both professional personnel and students in the educational system. The equipment for this type of television is being developed at a high rate and one of its main advantages is that it has been built for easy use. Both reel-to-reel and cassette video recorders are available at reasonable prices in black-and-white and in color. Special adjunctive devices are also available in portable styles to help improve the video product.

Battery-operated television equipment is increasing in popularity, available in both black-and-white and color and has a great variety of applications. Minimal expertise is required for the operation of this equipment; therefore, much experimentation and a resultant wide variety of quality are characteristic of videotapes of this nature. Mishandling of equipment which calls for high maintenance costs is prevalent. Portable equipment usually makes use of available light, both indoors and outdoors. A single microphone, either positioned at the camera or somewhere in the vicinity of the performers, is the usual procedure for sound.

The multiple uses for this kind of equipment make it a valuable tool. Such uses as magnification of images for demonstrations, sequences of non-classroom activities, immediate playback for evaluation, stop-action and slow motion, repeatability, interviewing, focus-of-attention, microteaching, study carrel viewing, in-service instruction and dramatizations are already in operation.

CONCLUSIONS AND RECOMMENDATIONS

In making recommendations for audiovisual equipment to colleges and universities, the size of the institution must be taken into account. The major considerations for the use of television on all campuses do not vary a great deal from one size campus to another except in quantity and sophistication.

Television studios are needed in some form on campus to provide closed-circuit television interconnections to various classrooms, to the Learning Resources Center (for group and individualized study) and to off-campus facilities. These studios can also help meet individual instructional needs better by producing video materials for specific needs on campus. Furthermore, campuses need such facilities to produce materials for off-campus study, in both closed-circuit television and video. Closed-circuit networks should also be considered as an aid in dispensing quality productions. Interconnections in terms of a network of multiple campus hook-ups are advantageous for the exchange of quality productions and communications.

In addition to their use on college campuses, closed-circuit networks have expanded to include public schools and industry. Television consortiums and networks are growing and centers for dissemination of video productions are becoming a necessary part of these systems.

The larger campuses are also considering the use of television for instructional purposes in course offerings leading to a degree or specific certification. The use of broadcast facilities makes these courses available for home viewers. Satellites, microwave and cross-country cables are being used. The development of more networks and cooperation between networks will gradually give us a greater selection in offerings and expertise. However, specific needs will still have to be met and conceptual short tapes will always be needed. Multiple channel cabling cannot handle all of these needs; so production of videotapes will be kept at the local level.

On the local level, videotapes will most likely be handled through the use of portable equipment. On all campuses a great need will continually exist for some sort of in-service training on the operations and especially on effective production techniques for staff as well as students using portable television.

It is becoming more apparent that producers of television programs are demanding more personal involvement and cooperation from users. In fact, television is a medium which has started to implement more social exchanges, both individually and collectively. For example, a person viewing a microteaching tape usually views it with another person. The resultant exchange of ideas, which might not have otherwise occurred, could improve a future teacher's skill. In a more direct way, exchange of video material between communities can generate interest in and understanding of different lifestyles or perhaps promote a sense of community brotherhood across a nation.

The audiovisual services or resource center is best equipped to purchase, store, dispense and maintain portable equipment. A high rate of equipment usage can be maintained through centralization of these services. Furthermore, standardization of equipment is made easier, and thus, combinations of equipment can be assembled for more complicated productions. When contemplating the use of portable television, consideration should be given to ease of operation, speedy access to off-campus repair services for major breakdowns and its use for specialized instruction application, such as television projection, cassette video, student use in carrels and automatic dial-access.

If the amount of equipment is not proportional to the size of the campus, it should be measured by demand and a complete needs' assessment study. Some special projects require long term usage; thus, equipment will need to be assigned to locations out of the center. Plans need to be made to allow for such long-term usage well in advance of the time needed. This means that some equipment will not be available for regular dispensing on either a daily or an hourly basis.

Many times such specialized uses are handled through approved research and instructional projects authorized by the administration and funded outside of both the audiovisual services department and the television department.

Since portable television equipment is more complex than other audiovisual equipment, good preventive techniques and a regular maintenance program are necessary. Short instructional sequences are necessary for any personnel operating such equipment. This can be done through audiovisual presentations on an individualized basis or personal instruction for small groups.

Tapes are another area which require continual monitoring. All too often, tapes which are worn out, particularly in their first sections, are being distributed for use. Consequently, a simple process for checking the wearing of tapes needs to be implemented. The life of the tape varies according to quality and, thus, monitoring of use is a necessary consideration. The storage of recorded and pre-recorded tapes varies according to the policy of television departments and/or audiovisual services. The policy needs to be clarified in terms of how many and what kinds of tapes will be stored.

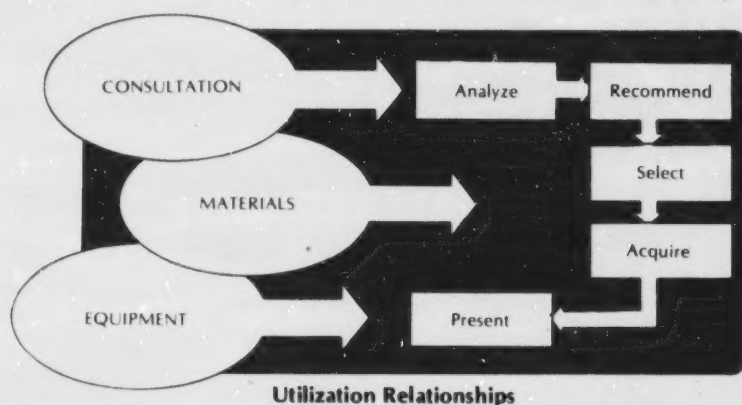
Television is here to stay. The success of television on any campus will be directly related to good planning, knowledgeable personnel and sufficient resources.

The Utilization Function

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INTRODUCTION

Effective utilization of learning resources materials can be realized only through a wide variety of support services. Such services must include consultation in the appropriate application of media to instruction and provision of required materials and equipment. (See below).



Utilization Relationships

An Educational Communications Consultant serves as the liaison between the university teacher and the technical services of the Learning Resources Service. He works directly with the faculty member in analyzing instructional content and recommends appropriate presentational formats. Materials are selected with regard for specific learning objectives and are acquired through rental, purchase or production. The presentation of instructional materials requires the availability of necessary equipment and a system for booking, distributing and maintaining such equipment. These services are basic to any program of instruction.

THE EDUCATIONAL COMMUNICATIONS CONSULTANT

Consultation is the central element of an effective learning resources program. Through observation, discussion, evaluation and coordination, the Educational Communications Consultant recommends a variety of learning resources as required for insuring effective instruction. His presentation knowledge complements the content expertise of the faculty member. As an instructional team they work together to design appropriate conditions for maximum learning. Through the consultation process all areas of the Learning Resources Service contribute to the learning process.

Functions

Selection of Instructional Materials: The Educational Communications Consultant assists the faculty member in the identification of those materials which are appropriate to specific learning objectives.

Design of Instructional Materials: Specialized instructional materials are often not available from rental or purchase sources. The Educational Communications Consultant designs such materials for local production with consideration for content requirements and quality standards.

Dissemination of Media Information: It is important that the university faculty member maintain an awareness of new materials, equipment and presentational techniques. It is the responsibility of the Educational Communications Consultant to disseminate and interpret such information.

Interpretation and Processing of Requests: As the liaison between the faculty member and the Learning Resources Service the Educational Communications Consultant is responsible for receiving and processing requests requiring application interpretation.

Design of Learning Environments: The effective application of instructional materials requires that they be presented in an environment designed with consideration for media utilization. The Educational Communications Consultant should influence the design of instructional facilities to permit adequate materials review.

Qualifications

Minimum of MA degree (doctoral degree preferable) with teaching experience at the university level; experience in media application mandatory; expertise in graphic design desirable.

Level

Determined by extent of media activity on each campus; minimum level of one Educational Communications Consultant per 100 faculty members.

INSTRUCTIONAL MATERIALS

Instructional materials found in college and university collections will consist of the same kinds of materials found in all other levels of education: motion pictures, video tapes, filmstrips, 2 x 2 slides, graphic materials, display materials, audio tapes, disc recordings, overhead transparencies, multi-media kits, models, realia and programmed instruction. The chief difference between college-level materials and other-level materials is, of course, the complexity and depth of their subject-matter content and the sophistication of their language and pictorial treatment.

Quantitative Considerations

Quantitative standards which specify numbers of items are quite inappropriate. Because college level curricula are universally non-standardized and because both curriculum and administrative decision-making is largely the prerogative of departmental chairmen and faculty, the individual college instructor exercises a great deal of freedom and individuality in the design and execution of instructional strategies.

If a materials' collection is to be responsive, then, to the content needs of a discipline and to the instructional strategies of a faculty, quantity decisions must be made locally and unencumbered by generalized quantitative standards. (For example, an academic program relying heavily on large group instruction might require sizable collections of overhead transparencies, 16mm films and 2x2 slides, whereas a highly individualized program might require collections of programmed instruction, realia, 8mm film loops and video tapes.)

Rather than numbers of particular items of media, a more appropriate quantitative standard would be: (a) an investment of a certain percentage of the total instructional budget—at least 3%, or (b) an allocation of funds for instructional materials on a per instructor or per student basis.

Qualitative Considerations

College and university students are among the most sophisticated of our society's viewers and listeners. Their literary tastes and discerning eye tend to reject ideas and pictorial-verbal stimulation that is less than accurate, relevant or useful. It is extremely important, therefore, that college level materials be evaluated chiefly on their degree of acceptance by, and contribution to, the learner. Qualitative evaluation of instructional materials should be made with reference to: (a) the learner, (b) the subject matter and (c) the medium.

More specifically, materials should be judged with respect to: (a) the learners' age, educational level, prior knowledge, attitudes and beliefs, psychomotor skills, communication skills, career goals and general life style; (b) the contents' accuracy, authoritativeness, relevance to the curriculum, organization, continuity and vocabulary level; and (c) the mediums' technical quality, intelligibility, visual appeal and suitability to the appropriate presentational strategy.

While certain qualitative decisions, particularly those regarding the medium, can be made by the Educational Communications Consultant, the importance of involving faculty in the evaluation and selection of materials cannot be stressed too highly. A balanced collection of materials which will most adequately reflect the needs of the curriculum will result most probably from the combined efforts and cooperation between the consultant and the faculty.

Acquisition, Housing and Distribution

Since there is such variation in the traditional patterns of instructional materials organization, it is difficult to specify universal standards by which these materials should be acquired, housed and distributed. By virtue of their high unit cost, their needs for specialized care and often their interdisciplinary nature, 16mm motion pictures, video tapes and some sound filmstrip sets and multimedia kits should be administered by a centralized coordinating agency, whether it be the Learning Resources Service, Library or Media Resources Center.* All other instructional materials should be considered departmental level materials, where their accessibility to faculty and students is potentially the greatest.**

The following general guidelines are suggested for the administration of instructional materials collections:

- Unnecessary duplication, and a wider dissemination of materials, can be achieved if all materials are purchased and catalogued by a central agency, regardless of where they are eventually housed.
- Duplicate materials may be necessary and justified, in the instance of identical items needed in an individualized instruction laboratory or in a department and also in the centralized resource center.
- Appropriate and working audiovisual equipment and viewing/listening spaces must be provided to accommodate audiovisual materials. (i.e., cassette tapes require cassette tape recorders-not reel to reel tape recorders.)

*It should be noted that in many cases, particularly in a college or university under 10-15,000 students, it is economically unwise to purchase 16mm films. Rather funds could be set aside for the rental of films from one of the many university film libraries.

**An exception, or addendum, to this guideline would be in the case of a college or university that maintained a media center, in which audio visual resources are made available to students and faculty in the same way, and for the same reasons, that print materials are made accessible.

- Proper maintenance of materials is extremely important. Damaged, lost or inaccessible materials are a liability. Responsibility for even the smallest of collections should be assigned to a competent overseer.
- The most well-designed materials for instruction are of little value if their availability is not compatible with instructional sequences. To insure that materials are provided as needed it is important that procedures for scheduling of materials be developed. Specific scheduling guidelines will vary between institutions depending upon the amount of faculty activity, the extensiveness of university owned material collections and the proximity of the institution to rental sources.

It is the intent of these guidelines for the selection and acquisition of instructional materials not to delineate a body of rigorous quantity and quality criteria, but rather to suggest general common-sense considerations which might stimulate a further research into the professional literature. In summary, an effective instructional materials program needs: (a) an administrative commitment, (b) competent professional leadership, (c) a balanced collection of quality media and (d) a service orientation whose chief aim is accessibility.

Personnel

Materials Coordinator

Nature of Work—Provides current information regarding materials availability to areas of instruction.

Examples of Work—Distributes information releases to appropriate faculty members regarding new materials; identifies materials available to support specific instructional units; maintains resource file of instructional materials information; operates and coordinates preview facility; catalogs and maintains instructional materials collections; supervises materials booking activities; conducts materials evaluation program; initiates orders for materials purchase.

Qualifications—Graduation from an accredited college or university with major course work in educational media.

Level—Determined by extent of media activity on each campus; minimum level of one Materials Coordinator per institution.

Booking Clerk

Nature of Work—Requests and schedules instructional materials for classroom application.

Examples of Work—Receives standard materials booking requests from faculty members; initiates booking correspondence for rental materials; schedules requests for university owned instructional materials; maintains records of materials utilization.

Qualifications—Training and experience in clerical work including typing, filing, book-keeping, etc.

Level—Determined by extent of media activity on each campus; minimum level of one Booking Clerk per institution.

INSTRUCTIONAL EQUIPMENT

The transmission of presentation of instructional information is becoming increasingly dependent upon equipment. Many university faculty members now require a wide variety of audio and/or visual equipment which, when properly utilized, becomes an integral part of the instructional program. The university Learning Resources Service assumes the obvious responsibility for the selection, acquisition, distribution, operation, maintenance and repair of such equipment.

Selection

The selection of suitable and cost-effective equipment for presentations and individual instruction is a major task of college and university media centers. The objective is to meet as many faculty and student demands as possible with the lowest cost and amount of idle equipment.

Quantity Considerations

Instructional equipment needs of each university are individually unique. Quantity standards must be established by each institution with respect to local needs evolving from instructional programs and faculty preferences. The following considerations determine the numbers and kinds of units or systems of equipment support:

What is the orientation of the university instructional program? Are undergraduate courses emphasized or is the instructional orientation primarily directed to a graduate level program? Is the curriculum primarily technical, liberal arts or professional in nature?

What are the formats of instruction? Do classes generally contain large or small numbers of students? What is the balance between classroom and laboratory activities? To what degree are systems of self-instruction being employed?

What is the nature of faculty media activity? Are faculty members supportive of mediated approaches to instruction or is the more traditional lecture method of instruction more popular?

What is the support/development capability of the Learning Resources Service? Are facilities available for the production of a variety of instructional materials? Are Educational Communications Consultants encouraging expanded media application to instruction?

The answers to these and other questions will vary with each institution. Only from local analysis can a meaningful program of instructional equipment support be developed.

Technical Considerations

The capabilities and characteristics of the equipment should match the particular needs of the software to be used and the instructional setting or settings in which it will be used.

Mediaware specification guidelines are explained in some detail in an article with this title in *Audiovisual Instruction* for June-July 1970, pages 106-109. The following questions are considered:

- How safe is it?
- How bright is the image?
- How faithful is the image?
- What constraints are made on image size and distance?
- How much light is spilled and where?
- What volume of sound is produced?
- What fidelity of sound is produced?
- What extraneous sound is produced?
- How hot does it get?
- What is its size and weight?
- What is its appearance?
- What convenience features are standard and optional?
- What are its power requirements?
- How compatible is it with other machines?
- What guarantee is provided and by whom?
- What service facilities are available and where?
- Does it damage or wear the materials used with it?

- What service is needed at what intervals?
- What do users report on experiences with this machine?
- What demonstration and training is provided?

An outline of specifications with blanks that might be filled in appears in "An Open Letter", *Audiovisual Instruction*, April, 1971, pages 82-83.

Acquisition

In the acquisition of instructional equipment, educational goals should be the primary consideration. The effective use of instructional materials is dependent upon the operating condition of the equipment which is provided. The quality of instruction is greatly reduced by inefficient equipment. The choice of equipment made by a faculty member should be considered by media personnel in terms of its capability of meeting the educational goals under consideration. If some other piece of equipment can better serve the educational requirements, it is incumbent on media administrators to help provide the information for the proper selection of this equipment to meet desired educational needs.

Bid Preparation

Most equipment purchased by the larger centers is done on the basis of lowest cost for the equipment that meets certain specifications. It should go without saying that the specifications should detail only those characteristics that are important to its applications and use. The characteristics that may be specified are indicated in the section above.

Centers that do not have the expertise to prepare detailed performance and physical characteristics ordinarily ask for bids on a familiar make and model known to be suitable for the intended use. It should be assumed that "or equal" is always included in such requests with the burden of equality falling on the vendor.

Bid Selection

When bids are submitted, a few days are usually allowed for consideration and decision. In the case of unknown or substitute "or equal" machines, the vendor may be required to supply a sample for tryout and/or testing by technical personnel. This testing must not harm the machine being tested. Only the actual characteristics specified should be considered. If the center intends to maintain and repair the equipment, then vendor proximity and shop facilities are of little importance. On the other hand, if the center cannot provide its own technical services, the the proximity, comprehensiveness, reliability and promptness of service is of prime importance. Centers must expect to pay for such service. A distant vendor who has sealed cartons shipped from a factory can sell far cheaper than a local dealer who provides demonstrations, maintenance, loan machines and repairs. Either can be better depending on the capabilities of the individual center.

Check-in and Inventory

Every center needs to develop a plan and appropriate forms for checking every new piece of equipment and entering it on suitable forms for accountability. Large centers may use computer storage for this information. Accessories and spare parts, such as lamps, must be checked and appropriate replacement ordered or stocked.

Distribution

The application of audiovisual materials to instruction is encouraged by the ease with which such materials and support equipment can be obtained for use. It is the responsibility of the university faculty member to organize and present instructional information. The Learning Resources Service holds the responsibility of assisting in the teaching process by

providing those materials and equipment items required by the instructional program. Inherent within this responsibility is the distribution of audiovisual equipment and materials to the learning environment in which they will be used.

Central Storage

The central storage area should have representative pieces of all equipment in the inventory for demonstration, tryout and loan as needed. It will also probably have the only pieces of new, complex, expensive or seldom used equipment. It must have loan equipment to temporarily replace that which is withdrawn from buildings, department or classrooms for repair or maintenance.

Building or Department

Frequently used equipment on an individual building or department basis should be conveniently located where it can most easily serve those who need it. Sub-media centers are often established in each major administrative or building unit. Larger sub-centers may have full-time staff in attendance. Smaller sub-centers will probably make use of departmental assistants specially trained by the center. The inventory of equipment may fluctuate constantly as equipment is moved in or out from the main center as needs change.

Individual Classrooms

Every classroom or presentation room and auditorium that is regularly used for the presentation of instructional materials should be permanently or semi-permanently set up for their easy use. Room darkening and light control are major problems considered in another section. Security for equipment in classrooms is another major consideration. Certain risks are inherent in any use of electronic-optical-magnetic-mechanical devices and they must be weighed against instructional effectiveness. Low cost storage of students is not a suitable substitute for higher cost effective instruction.

Operation

Many items of audiovisual classroom equipment are best utilized as an integral part of an instructional presentation. For example, the presentation of instructional concepts by overhead projection is more effective when paced and controlled at the discretion of the teacher. The presentation of adjunct materials such as 16mm films is usually mechanical and does not require teacher operation. It is important the the university teacher have an operational knowledge of the equipment with which he teaches. It is desirable, however, that assistance be provided for the operation of adjunct equipment freeing the teacher to provide appropriate continuity to the instructional sequence.

Operating Instructions

Every major and sub-center must have a place for the immediate and effective demonstration of equipment operation to faculty, support staff and students. Sample materials should be available for a practical rather than an academic or verbal explanation. Specially trained personnel who understand the equipment and who also understand typical non-technical potential operators are also essential.

Technical Staff Operation

Some equipment is best operated for faculty by a trained technical person. Examples are booth or auditorium equipment for large classes, new and/or complex equipment such as video tape recorders and specially adapted or interconnected multimedia or multi-screen materials.

Student Operators

Much equipment at colleges and universities is operated by trained and employed students. These students are usually the responsibility of the center but may be the responsibility of a sub-center. They must be technically efficient and also well trained in faculty relations.

Maintenance and Repair

All instructional equipment needs regular attention if it is going to perform efficiently over a long and careful life span. Maintenance refers to the cleaning, adjusting, lubrication and consumable or expendable parts replacement that can ordinarily be done away from the shop and without any special tools or special training. Repair ordinarily requires special tools, instruments and skill associated only with larger centers or vendors.

Maintenance is ordinarily done as near to the point of use as possible. Every machine that uses a projection lamp should have a spare with it and instructions for replacement. Cleaning and lubricating materials should be available at least at every sub-center. Many machines that are out of service for weeks to be serviced by distant shops could much better have been cared for where they are used with a little training and planning.

The establishment of a comprehensive in-house repair shop is a major undertaking involving highly trained personnel, a shop, considerable equipment and many tools. It must be weighed against the use of a vendor's facilities and the characteristics of those facilities. Some centers decide one way and some the other. Most of the largest centers have their own extensive in-house facilities. The smallest centers usually depend on vendors.

Personnel

Utilization Supervisor

Nature of Work—Supervises all functions relating to provision of instructional equipment.

Examples of Work—Coordinates program of review and evaluation of instructional equipment; determines specifications for equipment purchases; supervises equipment booking, scheduling and distribution functions; schedules equipment operators as required; maintains records of equipment utilization.

Qualifications—Supervisory experience and training in aspects of equipment operation and maintenance; BS or technical degree desirable.

Level—One Utilization Supervisor per institution.

Maintenance Technician

Nature of Work—Maintains all items of audiovisual equipment.

Examples of Work—Insures that all items of audiovisual equipment are properly maintained and repaired; schedules and provides periodic service on all items of audiovisual equipment; maintains inventory of maintenance parts; consults with other campus agencies regarding electronic equipment requirements.

Qualifications—Technical certification and experience in maintaining electronic equipment.

Level—Determined by extent and condition of equipment collections on each campus; minimum of one Maintenance Technician per each 500 equipment units.

Delivery Technician

Nature of Work—Distributes audiovisual equipment as required by instructional program.

Examples of Work—Distributes and collects instructional equipment as requested; operates specialized equipment as required; provides location servicing of equipment (i.e., bulb replacement, etc.) as necessary; schedules and maintains records of delivery services.

Qualifications—Chauffeur's license and familiarization with equipment operation.

Level—Determined by extent of media activity on each campus; minimum of one Delivery Technician per institution; delivery function may be assumed by students where utilization level is low.

Student Assistants

Utilization functions which do not require a high degree of skill and training may be assumed by students. Student employment permits personnel extension within the Learning Resources Service and also provides financial assistance necessary for many students to meet educational costs. Areas of student application within the utilization unit include the following:

- Set-up of equipment for instructional presentations
- Operation of projection equipment within the classroom
- Inspection and cleaning of instructional films
- Routine cleaning of equipment items
- Packaging of rental materials for return mailing

Facilities

G.F. McVEY, Boston University

INTRODUCTION

The teaching/learning situation has always included some instructional media, whether a book, chalkboard or projection film. The introduction of these media into the classroom inevitably alters the design of educational facilities. In the past, media use, especially projected media, was infrequent and teachers quite happily relegated its use to the school's 'audiovisual room'. Today, however, all this has changed. Instructional media has come to play a far more important and significant role in American education. Its sophistication, increased range, adaptability and availability have created a demand for developing environmental design concepts for its optimal use.

Planning and designing media facilities is a complex task, especially if the full potential of instructional technology is to be realized. Audiovisual equipment and materials can be useful to both teacher and student when they are effectively coordinated with the basic sensory processes and prudently integrated into the learning environment. However, when they add glare, noise or excessive heat to the learning situation, they vitiate the design of that environment and interfere with the learning process. Thus, it is important that the media specialist become versed in the ways which man and media interact with the environment. Of considerable help in this regard are a series of monographs published by the Educational Facilities Laboratories, 477 Madison Avenue, New York, N.Y., 10022. These include: *New Spaces for Learning* (1966), *Educational Facilities with New Media* (1966), *Multimedia Classrooms Revisited* (1971), *Designing for Educational Technology* (1971), *Instructional Hardware/A Guide to Architectural Requirements* (1970).

The above materials form the basis for the first part of this paper, an introduction to the general problem of considering the mechanical and operational aspects of media relative to the designing of the learning environment. Part two offers some specific technical and environmental considerations for the media and facilities specialist.

Much of the material used in this section has been extracted from *Man, Media and the Learning Environment*, G.F. McVey, 1973.

MEDIA AND FACILITIES

Since the need for special media facilities has only recently been recognized and multimedia instruction has only been recently incorporated into curricula, most media programs have been presented in environments not specifically planned for them. Some improvements of existing facilities have been undertaken (and these have increased the effectiveness of media), but educational facilities design, in general, has still lagged behind the development of communications technology. The result, predictably, has been to limit total media effectiveness. Even in schools currently under construction, classrooms are not being designed for media use; rather, they follow patterns which were established prior to the development of modern educational technology. What follows is some empirically supportable guidelines for designing the total learning environment so that instructional technology can be used at maximum effectiveness.

When we refer to instructional media, we are speaking of any and all devices that aid in the presentation of instruction, present the instruction itself and/or encourage learning. These devices and materials include projected and non-projected visual displays, various audio presentations, like recordings or broadcasts, audio/visual "combines," such as sound motion pictures, television and programmed instruction.

In designing facilities for using these media, primary concern should focus on the physical relationships between the media and the student and between the media and the instructor, for it is important that the instructor be able to present the material or lesson and that the student be easily able to see, hear and react to it. Since a wide variety of media is available, the teacher can select the kind or kinds of learning enhancement he thinks will be most effective either for a group or an individual student. There is no *one* best instrument to enhance learning; the appropriateness of the media depends on what is to be taught, the size of the group to be taught and the range of media available for instruction.

To provide guidelines for designing environments for media use, it is necessary to consider what specific learning spaces are involved. In most schools, these are usually confined to large-group classrooms seating 150 or more persons, regular classrooms and individual study carrels. In order to use most media, though, more than specific learning spaces have to be considered, since media technology requires facilities for production, origination and support as well as for retrieval and storage.

There are some basic principles underlying facilities for using instructional media that apply equally to large and small rooms.¹

For example, the room shape most effective for media use is determined by the optimum viewing area. Generally, this is a fan shaped area spanning approximately 70 degrees. Area will vary with the type of material being presented, the purposes of the presentation, quality of the equipment and environmental factors. Optimal viewing conditions can be enhanced through stepped or sloped floors. This is especially true of large-group spaces. However, in medium and small-group space stepped or sloped floors are unnecessary and, in some cases, objectionable. Building codes and seating type and arrangement (which are often intertwined) help to determine the actual capacity of a space as defined by viewing area.

Learning environments should be planned and designed so that the hardware and their components encourage, and in no way interfere or distract from the learning task. Lighting, acoustics, thermal factors, seating, color, hardware and the relationships of various spaces cannot be ignored. Windows generally detract from most instructional presentations and are a liability rather than an asset in rooms where media are extensively employed. Yet the need to have at least periodic visual contact with the "outside" environment is shared by most students. Thus, a modest and purposeful use of glass is recommended. Mechanical ventilation is essential to provide a stimulating environment and for the removal of occupant and equipment generated heat. All projection equipment noise should be isolated to prevent distraction and aid communication. The room should be insulated from sound generated outside of it. In large group areas, a high-quality sound system is often necessary for hearing ease and for enhancing the effect of any visual presentation. Lighting controls should be easily accessible to the instructor so that he can readily adjust them to the intensities deemed necessary for notetaking, conventional lecture, visual presentations and discussion. Such controls should be either of the pre-set or variac type. Comfortable seating, which promotes correct posture and also permits learning activities like notetaking, using reference materials, supporting books and personal school materials is desirable. In short, the design of a learning environment has to consider a whole range of variables—

¹Wilke, H. "Audio-Visual Systems for Large Group Instruction", *Architectural Record*, October 1962, pp. 172-175.

lighting, temperature, noise, sound system and seating arrangements. To provide for one and not the other would detract from the effectiveness of instruction.

It is not sufficient to design only one room for media use: learning today utilizes instructional technology of all kinds. Thus, every learning station in the school should be designed to potentially accommodate media instruction.

In constructing a school, cables and conduits should be installed initially and projectors, screens and TV receivers considered as a part of the total integration of the learning space. Equipment should be coordinated to facilitate interchangeability and growth and to provide economy of operation and maintenance. Also, media should be planned and organized to permit whatever multiple use is necessary, since two or more media often have to be used simultaneously. Whenever feasible, projection equipment should be centrally located and equipped with remote controls. Overhead projectors, of course, are usually the exception to this practice. Integrated and coordinated display surfaces (screens, liquid chalkboards, etc.) to facilitate the presentation of all instructional materials is recommended.²

Learning Stations

Large Group Space

Large group instructional space may be defined as a lecture hall type arrangement seating from 100 to 600 people (11-14 sq. ft./student in seating area). As groups increase in size to 40 or 50 people, the character of communication changes. As the numbers exceed 100, the changes become very definite and a totally new format of presentation occurs, with greater emphasis placed on one-way transmission of information and less on two-way interaction.³

Media to be used in large group learning spaces have to be strategically placed in order to enhance instruction and not to serve as environmental clutter. In determining location, several factors should be considered—such as the effect of this hardware on the lighting environment, climatic conditions and noise levels.

Different media require different levels of room illumination to reduce glare and eye strain and allow for optimum viewing. These levels range from full room lighting for overhead projectors and television reception to intermediate levels for slide projection and filmstrips and relative darkness for opaque projection and front projection of films. Given these needs, pre-set levels of lighting tied in with the projection equipment are most desirable. When widely varying illumination levels are necessary, incandescent fixtures wired to dimmers have proven to be the simplest and visually most comfortable solution.

Whenever projection media is to be used, controls ought to be readily accessible to the instructor at his lectern. Low voltage lamp on-off switches and focus adjustments that are remote controlled save numerous delays and disruption.

Apparent screen brightness is dependent on the light output of the projector. This is fundamental to producing a good image and is also critical in establishing acceptable ambient levels of illumination during projection. It is the ratio of image brightness to the non-image brightness that determines the acceptability of the projected image. Matte and Lenticular screens appear best for front projection, while specially coated translucent screens, made of glass, plexiglass or vinyl, work best for rear screen projection, their low reflection factor permitting greater ambient light in the room.

There are many arguments for and against both front and rear screen projection systems. These, along with pertinent data relative to general screen characteristics, are discussed in the next section. It has been the author's experience that both systems have their

²Hauf, H.D., et al. *New Spaces for Learning: The Design of College Facilities to Utilize Instructional Aids and Media*. Rensselaer Polytechnic Institute, Second Printing, 1971, p. 77.

³Haviland, D.S. and Winslow, W.F. "Designing for Educational Technology: A Guide to the Available Resources", *A I A Journal*, October, 1970, pp. 2740.

own particular merits and, therefore, both are recommended for inclusion in a large group room display system. Ceiling recessed, electrically controlled, front projection screens are preferred to the manual, pull-down type and glass or plexiglass rear projection screens are preferred over the flexible vinyl type. The use of rear projection necessitates additional space for housing projectors and related equipment. If space is limited, special projection lenses and a "light folding" projection system using mirrors may be employed.

Climatic conditions, especially temperature factors involving cooling or air conditioning of spaces, are greatly influenced by projection media. Maintaining proper oxygen content in the air is a negligible problem, but cooling problems necessitate introducing larger volumes of air.

Heat is generated by light and electronic equipment at the rate of 3.4 BTU's per hour per watt.⁴ Lamp wattage for various media range from 300 to 3000 watts or more, presenting a wide differential in the amount of heat added to a particular environment. Calibration of ventilation equipment to offset additional heat generated by projection is necessary.

Several kinds of ductwork systems and fans capable of quickly responding to increased heat loads are available. It is important to provide for adequate ventilation; failure to do so leads either to an uncomfortably warm environment or to an overburdened cooling system. Because ventilating systems are noisy, they should be located at some distance from the room they serve, lest they interfere with instruction. Sound absorbing material may have to be used to line ductwork to eliminate the noise.

Solid-state television projectors, monitors and receivers involve relatively few special problems for environmental design other than those already mentioned relating to light and glare factors which must be controlled.

Many types of instructional media produce noise which may hamper communication if not controlled. Unwanted sound produced by the media can be eliminated by isolation, in particular by enclosures for all projection equipment. Permanent booths can be installed in large group spaces for both front and rear projection. In addition, rigid, fixed, rear projection screens should be gasketed, since they are most susceptible to sound leakage. All projection areas should be lined with sound-proofing material and entrance and exit-ways should be solidly constructed and gasketed.

While sound identified as noise needs to be either absorbed or masked, other sounds—voice and audio program sources—very often need to be amplified to be audible. Electronically reproduced sounds are required in most learning spaces and provision should be made for their distribution.

A "centralized" sound system designed for use with all media and "tuned" to the room's frequencies is desirable. High-quality equipment with a reproduction range for full intelligibility and high tonal quality is most important. Such equipment must be housed and located to provide even distribution of volume and quality throughout the entire space with no feedback. Amplified live speech should appear to be coming from its source. Record and tape playing equipment, where necessary, ought to be within ready access and control of the instructor. Stereo sound systems might also be provided, should the room's activities necessitate the playback of stereophonic recordings. The use of a low level, distributed sound system is usually recommended only for rooms which have exceptionally low ceilings and a flat floor.

Small and Medium Group Space

The self-contained classroom facility (22' x 30') accommodating 30-40 people (15-25 sq. ft./student) remains a major component in the educational system today, although its

⁴Green, A.C. (Ed.). *Educational Facilities with New Media*. Department of Audiovisual Instruction (now Association for Educational Communications and Technology), Washington, E.D., 1966, p. C19.

character is ever-changing due to varying kinds of experiences now taking place in education. In such a classroom the teacher may choose to incorporate overhead, slide, film-strip and film projectors and videotape recorders and television receivers to enhance learning. Audiotape and phonograph recordings may also be an important aspect of his teaching. If a major adjustment in the room is necessary to accommodate such media, part of its value may be lost. Facilities ought to be designed for temporary and casual use of media equipment which can be stored and set up as needed with a minimal expenditure of time and energy.

Many problems of the large group space decrease in importance or disappear in small or medium rooms, but lighting control related to illumination levels and directionality and any resultant glare on screens, TV monitors and the like still have to be considered.

As with large group facilities, natural lighting still represents a liability to media projection and provision will have to be made for sufficient control of such lighting. Cable and conduit may be necessary to accommodate television monitors and special power sources for computer-based media. A ceiling and wall raceway system would serve to accommodate these services as well as the audio cable to serve motion picture speaker jacks at the front and back of the room.

Climate and temperature controls are important, but they do not present as much of a problem here as in large group spaces. The transmission of sound within the room and the isolation of sound from without can be provided in much the same way as in large rooms.

Flexibility of use dictates the exclusion in small and medium classrooms of such media-influenced large group design features as stepped floors. Economics usually excludes "special" air conditioning, and as mentioned earlier, remote controlled lighting, rear projection, sound amplification and special lighting fixtures. However, a degree of variable light control, even with standard fluorescent fixtures, is economically feasible by simply wiring the banks of lights in rows (widthwise) running from the front to back of the room. This way it is possible to simply turn off the front row of lights when the overhead projector or television monitors are being used. Similarly, the next row of lights can be turned off during slide and filmstrip viewing, leaving the last switch to turn off the last row of lights for opaque projection and motion picture projection. In this manner, ambient light levels may be maintained as high as possible for visual comfort and notetaking without compromising the quality of the projected image.

Individual Study Facilities

Independent study has become an integral part of education and, thus, of educational facilities planning. Within the school, individual study facilities should be liberally scattered throughout the building. If grouped in small clusters, several of them can share common rooms, services etc. Their requirements on the physical plant, such as lighting, acoustics, climate and engineering factors, can be more efficiently and economically provided when arranged in clusters. They should be located throughout the school in special project rooms, with classrooms, between classrooms and in resource areas.

The individual study unit may be an enclosed or semi-enclosed carrel, room, cubicle or any other facility designed especially for such purposes. Whatever their basic form, these learning facilities should be designed as independent bits of space which will appease the student's sense of territoriality and minimize external environmental distractions.

The carrels may be of the traditional "dry" variety, wherein there is no provision for electronic resources; they may be "wet" stations containing specific built-in or portable independent study equipment (tape recorder, microfiche readers, teaching machines); or they may be "wet" carrels, connected to school-wide audio, audiovisual or computer networks (dial access and computer-assisted instruction). Generally, combinations and variations of

these units are considered desirable to cater to individual preference and to handle various tasks economically. Carrels with listening and recording capability, of the type used in language laboratories, require special ancillary equipment such as teacher consoles, monitoring facilities and tape recording storage. Special provision must be made for conduit from the teacher's console to floor boxes throughout the center.

Quantity and quality of lighting varies with the particular task going on in such facilities, but overall illumination should be diffuse and shadow-free with emphasis given to local lighting of work surfaces. Acoustical problems can be solved through the use of headphones. Some areas, such as those used for recording, must be kept relatively free from intruding noise. Distraction (noise, unnecessary traffic, glare and drafts) should be designed out of such areas. Air exchange must be frequent and temperature and humidity kept within acceptable ranges. Good ventilation and appropriate temperature and humidity levels should be maintained.

Where computers are used, cabling with an elevated floor is essential. The computer room, if there is one, should have a strictly controlled, dust-free environment which has been acoustically treated to prevent noise transmission.

Independent study carrels are often used as the terminals for computer-assisted instruction (C.A.I.) and, in such cases, need to be equipped with devices such as tele-typewriter, page printer, screen (cathode ray tube), electronic light pen, image projectors, tape playback, earphones, speakers and so forth. The terminals may be connected to a computer at some centrally located site other than the school building itself. If this is the case, high-speed telephone lines are used for the hook-up from central processor to regional line concentrators which direct and control messages between central processors and terminals. Telephone lines must be installed to transmit signals from terminals to so-called regional sites in the building and vice versa. These are relatively easily accommodated within existing facilities.

Space requirements for C.A.I. include terminal station space, machine area for on-site equipment, maintenance service area, storage areas for magnetic tape, cards, etc., and central site space. Information on C.A.I. needs is readily available in the literature.⁵ If the C.A.I. originates within the school, it is more efficient to locate it near the source of power and air conditioning. For economic reasons, the units should be placed near shipping and storage facilities. C.A.I. equipment use creates a demand on the air conditioning system far in excess of that needed for normal instruction areas. This entails enlarged ductwork mixing hoses and diffusers and may even require additional ceiling space.

The cabling requirements between terminals and central or local control units are regarded as the most restrictive elements of C.A.I. Specific requirements are detailed in *Instructional Hardware/A Guide to Architectural Requirements*, as are outlines of various systems of routing wire and cable between computer system components—floor trench, raised floor, cable ramp, underfloor raceway, cellular floor, ceiling space, wall raceway. The use of any of these is dependent on the existing facilities and/or economic factors.

A typical computer system requires electrical power that is generally available in most buildings (120 or 208 volts $\pm$ 10%; frequency 60 Hz), with general requirements of 0.5-1.0 KW for each student station, 1.0-5.0 KW for control or communication unit and 6.0-20 KW for the central computer room. However, the overall electrical power distribution system must provide for the additional demand on the constant air conditioning system and for the probability of maximum use of all terminals.

⁵E.F.L. *Instructional Hardware/A Guide to Architectural Requirements*, Educational Facilities Laboratories, New York, 1970, pp. 63-98.

Equipment

Television

Television is one electronic device which can be used successfully in all major instructional settings: large (assuming the availability of a TV projector of acceptable quality), medium and small group and independent carrels.

Coaxial cable between studio and control and distribution centers for a "closed," "in-house" TV system may be easily accommodated by false floors, false ceilings and walls with accessible spaces for cabling all areas where equipment terminates. Major vertical runways for cables between floors and a horizontal network of cable-ways would provide building distribution. The use of microwave transmission systems should be considered when distribution is required over relatively long distances.

Television production has specific engineering requirements which are competently discussed in a number of readily available publications. A very thorough treatment of its lighting requirements is presented in the *IES Lighting Handbook*.⁶

The use of television in the classroom as a display device requires very little in the way of environmental modification. Its image brightness is such that it requires no special darkening procedures unless it is located right next to a luminaire, in which case the individual luminaire can be wired to turn off automatically when the TV monitor is turned on. Care should be taken that the monitor is not mounted directly against a common wall or it will transmit noise in the form of vibration to the adjacent classroom.

Dial Access

Typical devices for dial access equipment include dial, touchtone or keyboard controls for selection; earphones or speaker for listening; teacher-call, microphones or intercom phone for responding; tape recorder and/or controls for recording; TV screen for viewing; and on-off volume control switches.

Space requirements relate to two areas, user location and information storage and control areas. User location refers to the typical carrel. Information storage and control areas should be located as close to dial access stations as possible so that telephone lines and coaxial cable can be kept as short as possible. Dial access stations are usually located in the materials resource center, specialized media classrooms and in selected independent study facilities.

Multi-Facilities

A multi communications system, which provides for audio and video information between and among all classrooms, offices and studios of the school, certainly enhances the use of media in the school plant. Clocks, telephones, intercom, microphone and television jack, light controls and temperature controls can all be interrelated with such a system and become an integral part of the media system of the school.

Centralized Media Centers

In *Creative Planning of Educational Facilities*⁷, Basil Castaldi discusses in detail the concept of the Library-Communications Center. He states "... there is a unity in the media of all communication and the library is strategically equipped to provide the unifying vehicle."

Castaldi goes on to explain this concept and cites a plan developed by Louis G. Vagianos, University Librarian, Brown University, of a facility capable of serving an enrollment

⁶Kaufman, John E. (Ed.). *IES Lighting Handbook*, Fourth Edition, 1966.

⁷Castaldi, Basil. *Creative Planning of Educational Facilities*, Rand-McNally, 1969.

of 6,000 students and 300 faculty. Table 1 shows the space allocation for the various functions housed in this building. It will be noted that the center includes, along with the standard library-associated spaces, other media-oriented areas such as: the copy room, an instructional materials production area and work room, self-instructional carrels, listening rooms, an office for the audio-visual librarian, a set of conference rooms, a television studio and production center and a computer laboratory.

Such a concept and spatial commitment deserves the consideration of any college or university unit of similar size. However, this writer believes that a number of specialized presentation rooms and support areas should be added to make optimum use of this plan. These would include a presentation complex consisting of four different presentation environments; a large group presentation room, a medium-large group presentation room, a flexible presentation room for small and medium sized groups and a conference presentation room. Each room would be designed for extensive media use and characterized by an architectural design appropriate for the group size and proposed social interaction and communication pattern.

All four of these multimedia presentation rooms would be physically linked to a central rear-projection area. The largest presentation room would also be equipped with a front projection booth. The rear projection facility would be functionally linked to a program preparation room where instructional materials produced or collected specifically for use in the presentation space could be stored, set up and previewed before use. The preferred location for this room would be directly above or below the rear projection room, accessible by a freight elevator. Additional components of this preparation room would include a photographic darkroom, an electronics and mechanical repair shop and a set of offices for the presentation coordinator and his staff.

TECHNICAL AND ENVIRONMENTAL CONSIDERATIONS

Basic Technical Data: Projection Systems

Types of Projection Systems

There are two main types of screens used in conventional projection systems: rear projection screens (RP) and front projection screens (FP). Some basic advantages and disadvantages of the two types are shown in Table 2. Within these two major categories there are a number that have distinct gain and distribution characteristics which affect their appropriateness for different facilities.

FP Screens

- 1) *Matte White Screen*—angular coverage: 100°+

Low gain (85%), fixed screens available in stretch vinyl; roll-down type available in flame resistant cloth. The pull-down type is recommended for all types of projection in standard size classrooms. The electric roll-down type is recommended for large group presentation rooms and auditoria, particularly in situations where high light output projection equipment is available.

- 2) *Beaded Screen*—angular coverage: 40-50°.

High gain (600% for early models, 300% for current microbead models) at 0°, low gain (80%) at 20° bend angle; requires totally darkened room for most kinds of projection. Recommended for long, narrow, large-group presentation rooms where standard projection equipment is used to produce images greater than 10 feet in width.

- 3) *Lenticular Screen*—angular coverage: 90° horizontally and 25° vertically. Moderately high gain (180%) at 0° and 80% at a 50° bend angle. Available up to 70" x 70" in tripod or wall units for small classrooms. Larger sizes available only for fixed installations. The pearl-white version is recommended for movie theatres or large-group spaces where a fixed projection screen is possible. Silver and black lenticular materials are available for special purpose use.

Table 1
Space Allocation for a Library Communications Center*

<i>Function of Space Allocation</i>	<i>Suggested Net Area</i>
1. Book collection: 400,000 volumes @ 15 volumes/sq. ft.	26,667
2. Space for Reading: 1,250 @ 30 sq. ft./reader	37,500
3. Administration: 1 office @ 250 sq. ft. (Librarian)	1,200
1 office @ 225 sq. ft. (Assistant Librarian)	
1 office @ 225 sq. ft. (Secretary)	
1 Conference Room @ 500 sq. ft.	
Initially 3 staff with no student assistants	
4. Technical Processes: 2 offices @ 200 sq. ft. (one for Head Cataloger, one for Head Order Librarian)	5,000
Initially 8 staff plus 10 student assistants	
5. Circulation Department: 1 office @ 200 sq. ft. (Circulation Librarian)	5,000
1 workroom @ 2,000 sq. ft.	
1 Reserve Book Room @ 2,800 sq. ft. (seating for 150 students at tables or carrels)	
Initially 6 staff plus 20 student assistants	
6. Public Services: 1 office @ 200 sq. ft. (Reference Librarian)	6,600
1 workroom @ 800 sq. ft.	
Initially 6 staff plus 5 student assistants	
Seating for 100 students at tables or carrels should be provided in this area.	
7. Public Catalog	1,500
8. Staff Lounge	1,000
9. Faculty Studies: 50 studies @ 90 sq. ft.	4,500
10. Map Room	500
11. Copy Room	500
12. Instructional Materials Production Area and Workroom	1,200
Self-instructional	
Microtext cubicles 100 @ 30 sq. ft./person	3,000
Listening Rooms	
1 office @ 200 sq. ft. (Audiovisual Librarian)	200
1 storage area @ 500	500
Initially 2 staff plus 10 student assistants	4,900
13. Conference Rooms: 3 @ 250 sq. ft.—cap. 10	2,850
3 @ 300 sq. ft.—cap. 12	
3 @ 400 sq. ft.—cap. 16	
14. Television Studio and Production: 1 office @ 200 sq. ft. (Supervisor)	3,000
Initially 2 staff plus 5 student assistants	200
15. Computer Laboratory: 1 office @ 200 sq. ft.	2,500
Initially 2 staff	200
16. Receiving	1,000
Initially 1 staff	
17. General Storage	1,000
TOTAL NET AREA	105,617

*From Castaldi, Basil. *Educational Facilities*. Allyn and Bacon, Inc., 1977, p. 475.

Table 2
Comparison of Front and Rear Screen Projection for Various Considerations*

CONSIDERATION	FRONT PROJECTION	REAR PROJECTION
	(Projected to opaque screen from viewing side of screen)	(Projected to translucent screen from side of screen away from audience)
Proximity of Lecturer to equipment	REMOTE—without equipment attendance or automation—requires lecturer to go through audience to tend equipment.	CLOSE—with or without equipment attendance or automation—lecturer in close to equipment for tending.
Method for providing central attendance	Racetrack continuous projection booth over perimeter corridor	Central projection area (requires additional building space)
Programming	Requires careful programming	Simpler programming, less wiring
Emergency tending	Emergency tending difficult unless signal system provided	Emergency tending good. Care must be taken to prevent attendant from crossing other projections
Screen and seating	High gains through wide angles permit greater seating	Viewing side angle not as great for same values of gain
Projection distance	Projection over audience may be slightly distracting	Accomplished at sacrifice of space, and light intensity if mirrors are used
Noise	Noisy if equipment is in room. Absolutely quiet if equipment is in booth.	Some machine noise will penetrate screens
Tending of Equipment	Distracting and noisy if in viewing room. Not noticed or heard if in booth.	Some noise may be heard through screen. Movement behind screen may be distracting.
Projector light as source of incident light on screen	Undesirable in room. Non-existent from projection booth.	Causes some incident screen light. Requires dark-colored, light-absorbing paint and shielding in room area back of screen.
Overhead Projector	Conspicuous in room. Lecturer in central position. Attendant optional.	Equipment not conspicuous. Lecturer not in room. No attendant required.
TV Projector Application	Conspicuous	Inconspicuous
Interpositioning	Front screens not usable for rear screen projection.	Rear screens may be used for front projector with some sacrifice of transmission and gain.

*Taken from *Space for Audio-Visual Large Group Instruction*, UFRC, Madison, Wisconsin, 1963.

- 4) *Aluminum Foil Screen*—Angular coverage 50° horizontally and 20° vertically. Extremely high gain (1700%) at 0°, but rapid fall off beyond 20° each side of projection axis. Delicate surface and relatively small size (maximum standard size 40" x 40", slightly larger size available on special order) makes it less suitable than the roll-down matte white or the lenticular for standard classrooms. Its high gain and ability to reject stray light make it particularly suitable for small-group work in spaces where room lighting is very high.

Rear Projection Screens

A commercially produced RP screen consists of a base and a microlens coating. There are three general types of bases used: glass, plexiglass and flexible vinyl. These rank in the same order in superiority of performance and cost.

RP screens, like FP screens, come with different gains and angular coverage. A low gain (120% at 0°) RP screen is recommended for rooms with wide viewing sectors (over 70°) and a moderately high gain screen (250% at 0°) is recommended for narrower viewing sectors, particularly in cases where standard projection equipment is used. A high gain (1400% at 0°) screen is not recommended for conventional educational use, since it is characterized by an objectional "hot spot" during projection. There are also RP screens which have been designed for both front and rear projection, but like the high gain screen, they are recommended for special projection purposes only.

Recommendation

For greatest versatility in specialized medium and large-group presentation rooms, both FP and RP systems should be installed. The author's first choice for an FP screen would be an electrically controlled, matte-white screen. For rear projection, a 3/8" to 1/2" glass RP screen with a gain of between 250% and 300% should be selected for relatively narrow, large-group viewing areas. A glass lenscreen, with a gain ranging between 120% and 180%, should be used for rooms having a relatively wide viewing area (greater than 70°).

Projector-Screen Relationships

Four factors which determine the location of projectors and/or the appropriate lenses for a fixed facility are:

- Width (in inches) of the film frame being projected (a)
- Focal length (in inches) of the projection lens (L)
- Projection throw in feet (d)
- Width (in feet) of the image on the screen (s)

The relationship between these factors is well enough expressed, for most purposes, by the formula: $S = \frac{da}{L}$. We can use this formula to determine any one of the four variables if the

other three are known (see Table 3). For the reader who does not wish to use the formula, it should be noted that the *NAVA Audio-Visual Equipment Directory*⁴, in addition to its comprehensive listing of commercially available "hardware", also provides a series of charts to assist the media specialist in the selection of appropriate lenses for given projection distances and image sizes.

Once the width of the screen image is known, its height can easily be calculated by applying the width to height ratio for the particular film or slide being projected (see Table 3).

⁴NAVA. *The Audio-Visual Equipment Directory*, 20th Edition, 1974-75, Fairfax, Va.

Table 3
Aperture Measurements of Different Projection Media

Film	Aperture Width (in inches)	Aperture Height (in inches)	w/h ratio	(approx.)
Reg 8mm	0.172	0.129	1.333	(4 to 3)
Super 8mm	0.211	0.158	1.335	(4 to 3)
16mm movie (standard)	0.380	0.284	1.338	(4 to 3)
Instamatic	1.043	1.043	1.000	(square)
35mm (single frame) filmstrips	0.860	0.650	1.323	(4 to 3)
35mm (double frame) slides	1.344	0.906	1.483	(3 to 2)
35mm movie (standard)	0.825	0.600	1.375	(2-3/4 to 2)
2x2 (super-slides)	1.500	1.500	1.000	(square)
2-1/4 x 2-1/4 slides	2.188	2.188	1.000	(square)
3-1/4 x 4 slides	4.000	3.250	1.230	(5 to 4)
Overhead projection	10.000	10.000	1.000	(square)

Determining Projector Brightness

Table 4 shows the recommended screen brightnesses for different projected images. Screen brightness is primarily the result of two factors: projector luminance and screen gain.

A simple way to determine the required light output for a proposed projection system is to take the area of your projection surface (in square feet), divide it by the screen gain, and then multiply this by the recommended screen brightness (in foot lamberts) for the particular medium under consideration (as shown in Table 4). This will give you an acceptable approximation of the required projector light output in screen lumens. A more comprehensive method of determining this is provided in the literature.⁹

Today the problem of setting up a projection system has been facilitated by the fact that most projector manufacturers will provide such information in their technical specifications and that there is a wide range of projection equipment available to meet special operator needs and performance requirements. In general, projectors should be chosen on the basis of how well they measure up when evaluated on the following points: availability, acquisition cost, maintenance cost, ease of operation, ease of maintenance cost, dependability, light output, resolution, color capability, sound fidelity, sound volume, appropriate lenses, noise and heat production, remote control capability and compatibility of components.

Basic Environmental Data

Visual Learning Environment

Viewing Distance and Screen Size

It is impossible to identify with complete confidence any one image size-viewing distance relationship as the best for all display purposes. Most media specialists recommend a minimum viewing distance of two times the screen width (2W) and a maximum viewing distance of six times the screen width (6W).

⁹Bretz, Rudy and McVey, G.F. "A Nontechnical, Nonmathematical Approach to AV Planning-AV Beyond Basics". *Educational/Instructional Broadcast*, Sept., 1970, pp. 17-26.

Table 4
Recommended Screen Brightnesses for Different Projected Images*

Motion Pictures

- **5 ft. L.: Minimum (Marginal for some observers)
- 10 ft. L.: Satisfactory
- 15 ft. L.: Excellent
- 20 ft. L.: Maximum (flicker threshold for some observers)

Slides:

- 1 ft. L.: difficult to distinguish color from black and white
- **2.5 ft. L.: minimum for gross images
- 5 ft. L.: minimum for slides with detail
- 10 ft. L.: satisfactory
- 20 ft. L.: excellent

(Theoretically, the upper limit for slides is the tolerance limit of the eye. For practical purposes, economics and projector limitations will control)

Projected TV:

- **2 ft. L.: Gross black and white images
- 20 ft. L.: Maximum, flicker threshold

TV Monitors:

- 100 lumens per sq. ft.

- *American Standards Association (A.S.A.) standards
- **Added by Caravaty and Winslow (1964) who tested A.S.A. standards and modified them for classroom use.

While guidelines work well for conventional film-based media viewing, their application to special viewing situations will not produce optimum results. For example, they do not apply to multi-image or television display, nor do they work for the unfortunate, yet almost universal situation where instructors do not observe recommended legibility standards, i.e., producing overhead projectuals from standard typed originals on 8 1/2" x 11" paper stock using a fast copy transparency maker.

Because of this, the author has developed for the reader a table showing different viewer-display distances and their visual correlates. This table attempts to reflect the perceptual, viewing comfort and legibility factors inherent in special viewer-display events and, hopefully, will help the facility planner in selecting a screen size appropriate for his particular situation (see Table 5).

Viewing Angle

Whenever a person is required to view a display from an angle deviating considerably from the perpendicular (direct line of sight), losses either in viewing accuracy or visual comfort occur. Figures 1 and 2 show this, as well as other display-viewer distance considerations. These drawings will help the media specialist and school planner determine the length/width and inclination of the viewing area in a large-group classroom or auditorium.

In this type of room, the bottom of the projection screen should be at least 4 feet, but not more than 6 feet, from the floor. In a standard classroom, the bottom of the projection screen should be 3 feet from the floor when the seating arrangement provides each student with an unobstructed view. It should be 4 feet from the floor when seating is arranged in conventional rows. The screen should be mounted about two feet from the wall so that it can be pulled back at the bottom to minimize keystoneing.

Table 5
Viewer Display Distance Recommendation

Screen-Viewer Distance Ratio	Visual Correlate
1W	Recommended minimum distance for multiscreen viewing.
1.3W	Distance where projected scene has same perspective as camera which recorded the scene. Recommended distance for media presentation which attempts to simulate realism.
2W	Cone of regard wherein 70% of total acuity takes place. Recommended minimum distance for most media viewing where comfort and visual detection are primary concerns.
3W	Recommended maximum viewing distance for multiscreen viewing.
4W	80% total acuity. Recommended minimum distance for television viewing or other low resolution display systems. Recommended maximum viewing distance for displays having exceptionally small symbols, i.e., overhead projection of transparencies produced 1:1 from standard typed copy.
6W	Recommended maximum distance for viewing most media particularly commercially produced motion pictures. At this distance eye fixations are evenly dispersed throughout display area.
10W	Recommended "ideal" maximum distance for viewing television.
14W	"Traditional" maximum distance for viewing television.
20W	Distance which allows whole display to fall on most sensitive part of retina—highest level of acuity. Recommended maximum size for important features contained in a visual display.

Illumination

The optimum illuminated environment is one which results from the effective coordination of lighting quantity and quality as well as directionality in keeping with surface colors and reflectivity. The following explains the various components of illumination and some basic recommendations:

Illumination level—General classroom activities: 30-50 foot candles—critical visual tasks (art work, etc.); 100 foot candles—audiovisual activities, variable from 0-30 foot candles; dimmer controls—either AC variac or silicon-controlled rectifiers (SCR) type (grounded independently to avoid interference with audio systems).

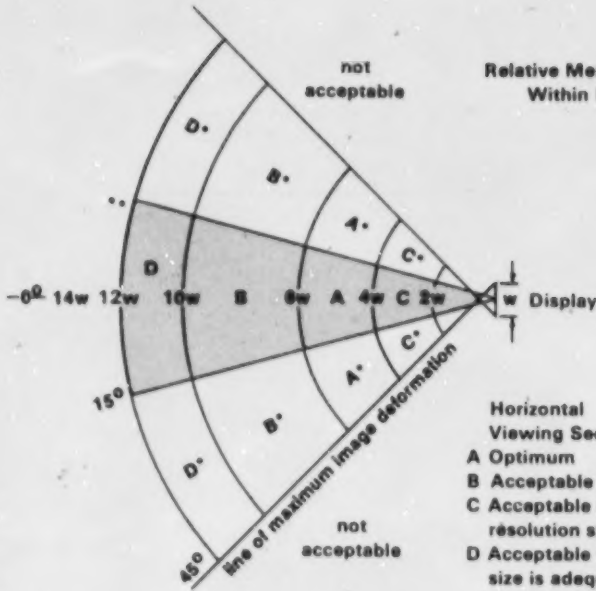
Reflectances—Desk tops: matte finish, 30-50% reflectance; floors: natural woods or light colored tile or carpet, 30-50% reflectance; chalkboards: green, not to exceed 20% reflectance grey of black, not to exceed 10% reflectance; walls: matte finish, 40-60% reflectance; ceiling: matte finish, 70-90% reflectance.

Brightness Contrasts (BCR)—General recommendations: The BCR of large adjoining areas should fall somewhere between 1:1 and 3:1 ratio, with the task area being brighter than its surroundings; for small adjoining areas under low light levels, the acceptable BCR will range between 3:1 and 10:1.

Glare—Most glare in the classroom can be eliminated or reduced by the following methods: providing shades or drapery for all classroom windows which have outside exposure (solar shield also desirable); equipping fixtures with some directional or diffusing device; locating all luminaires so that their major light transmission does not fall within the

Figure 1

Relative Merits of Different Viewing Locations
Within Horizontal Viewing Sector (1)



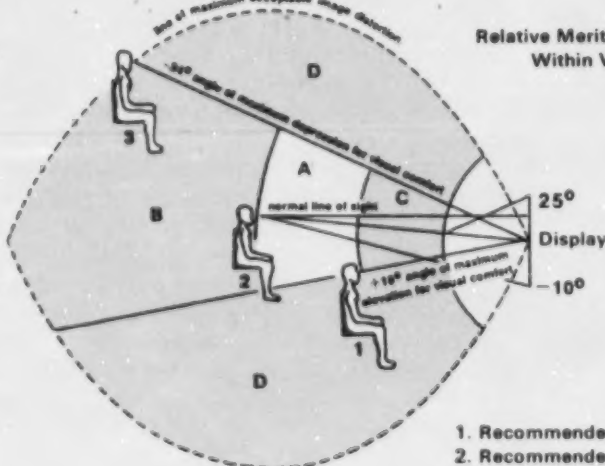
Horizontal
Viewing Sector
A Optimum
B Acceptable
C Acceptable for high
resolution systems
D Acceptable when symbol
size is adequate

* Requires compensatory head movements which
promote fatigue

** Fan-shaped viewing sector based upon adjustments
in angular viewing distances from 0°

Figure 2

Relative Merits of Different Viewing Locations
Within Vertical Viewing Sector (1)



Vertical
Viewing Sector
A Optimum
B Acceptable
C Acceptable for high
resolution systems
D Acceptable, but with
high fatigue factor

1. Recommended max. viewing angle-front row.
2. Recommended max. viewing angle-rear row.
3. Not recommended for media viewing but acceptable
for science and medical demonstration rooms.

zone measured 45° above the student's line of sight; and avoiding having glossy or specular surfaces in the classroom.

Flicker—All light sources which produce a noticeable and discomforting flicker should be either modified or eliminated from the classroom. Typical sources of flicker include: excessively bright luminaires, excessively bright motion picture projection, defective lamps, the ends of fluorescent lamps, excessively bright television picture tubes and strobe lights.

Color Rendition—Since all types of illumination reproduce colors differently, luminaires (incandescent or fluorescent) should be chosen on the basis of their color appearance and color rendering qualities. Recommendation: incandescent "on" dimmers for low-light levels used in specialized media presentation rooms; cool white or warm white fluorescent for general classroom lighting; deluxe warm white fluorescent for reception areas where natural-looking skin tones are desired; General Electric Chroma 50 or Chroma 75 (or equivalent) for special graphic and visual arts rooms.

Fluorescent or Incandescent Lights—Since the research indicates that one can expect relatively little difference in visual acuity and comfort with either fluorescent or incandescent lights, the selection of lighting systems should be based on factors other than visual performance. Some recommendations follow: use incandescents when variable intensities and directional control are needed; use fluorescents when illumination levels exceeding 50 foot candles are desired; use fluorescents when long life and low heat gain are required.

Color—When used properly and combined with the right kind of illumination, color can be an effective tool for the school designer and classroom teacher. Both as a surface treatment and as an illuminant, color has relatively predictable behavioral concomitants. Different colors evoke different physiological arousal levels and attitudinal responses and produce different psychospatial effects, which can be used effectively by the school designer in his treatment of the school interior and by the classroom teacher in the arrangement of displays and modification of the school's work and study environment.

Therefore, it is recommended that: rooms to be action-oriented should be decorated in 'tints' of the warmer colors (yellow, orange, red) and those planned for quiet activities in 'tints' of the cooler colors (green, blue).*

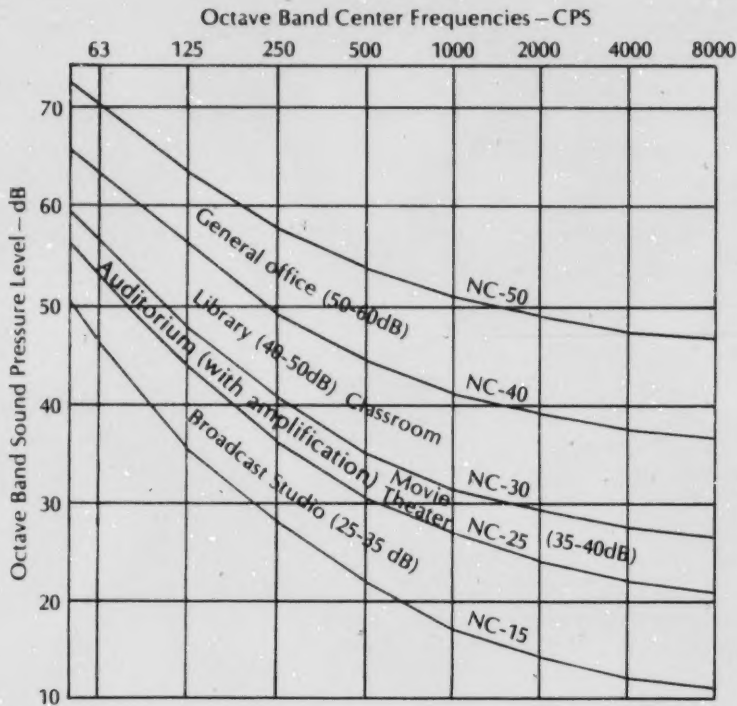
Bold, fully saturated colors, particularly reds and blues, should be avoided for general wall treatment, especially on surfaces which may be used as backgrounds for visual displays.

The Acoustical Learning Environment

Easy audibility depends greatly on the difference between the level of informational sound and the level of background noise (signal to noise ratio). The minimum acceptable signal to noise ratio is 10 dB. Since normal speech generally registers 60 dB, it stands to reason that the background noise level (in the speech frequencies) should remain well below 50 dB. A totally quiet room is also not recommended; a certain amount of background noise is necessary to mask the non-informational sounds created by classroom activities, i.e., writing, page turning, etc. Background noise levels recommended for different types of rooms are shown in Figure 3.

The surfaces of a room give it its sonic character. A room containing mostly sound-reflecting surfaces will tend to have a longer reverberation time than a room of the same volume containing mostly sound-absorbent materials. A room's reverberation time affects the intelligibility and aesthetics of the sounds and words heard and limits the type of audio activities appropriate to the room (see Figure 4).

*The word 'tints' is used to emphasize a desaturated color.



RECOMMENDED NOISE CRITERIA FOR ROOMS
 Shown by NC Curves and Average dB Level
 Figure 3

ACTIVITIES AND RECOMMENDED REVERBERATION TIMES

Speech recording and broadcast	0.4 — 0.6 seconds
Elementary classrooms	0.5 — 0.9 seconds
Motion picture presentation	0.6 — 1.2 seconds
Lectures and other activities using sound amplification	0.6 — 1.2 seconds
Musical comedy	1.0 — 1.4 seconds
Drama	1.0 — 1.4 seconds
Opera	1.2 — 1.6 seconds
Piano recital	1.2 — 1.6 seconds
Voice and violin recital, string quartet, chamber orchestra	1.4 — 1.8 seconds
Symphony orchestra (contemporary works)	1.3 — 1.6 seconds
Symphony orchestra (Brahms, Wagner)	1.8 — 2.0 seconds
Liturgical choral music, organ	1.8 — 3.0 seconds
Medieval liturgical works	4.0 — 8.0 seconds

Figure 4

Regulating Classroom Noise Levels

In the standard classroom, noise reduction is accomplished by standard isolation and absorption techniques, acoustical tile and drapery or carpeting on the rear wall. Tile around the edges of the ceilings and at the tops of side walls is sufficient for most purposes. A carpet on the floor generally completes the treatment.

Keeping the surfaces above and behind the teacher hard and sonically reflective (chalk-board behind her and no tile on the front central section of the ceiling) facilitate good voice projection. In the large-group media room, the recommended acoustical treatment is more extensive.

Basic Recommendations

1. The best shaped space for acoustical performance is a room with a ceiling-to-height ratio back to front of 2:3 and width to length ratio of 3:5.
2. The orientation of the room's walls, ceiling and floor should be such that sound is projected and reflected from the front of the room toward the rear. To accomplish this, front and side walls should be non-parallel (splayed). Floors should be stepped or inclined.
3. The ceiling in the front half of the room should be sonically reflective. If reflecting panels are used, they should be no smaller than 10 feet wide. The ceiling section over the speaker (instructor) should be inclined toward the audience in such a manner that most of his voice is projected forward, although a small part of it is reflected downward so that the instructor has no difficulty hearing himself.
4. Rear walls should not be curved (to avoid focus of reflected sound waves). They should also be covered with a highly absorptive material.
5. Whenever economy permits, seats should be upholstered and carpeting provided throughout. Carpeting in the perimeter of the room is essential.
6. The room should be insulated against outside noise. Walls with a noise attenuation of 45 dBA are recommended.
7. Enclosures should be provided for the projection systems. Glass rear projection screens, resiliently mounted, provide adequate sound isolation for equipment operations behind the screen. The front projection booth should be equipped with two 1/4" plate glass panels separated by an air space (4-8") properly caulked and resiliently mounted.

Additional Considerations

1. Fluorescent light baffles should be acoustically isolated.
2. All plumbing noises should be isolated from the large-group media room. Flexible connections should be installed near the pump and air chambers provided in water fixtures to avoid "water hammer". Piping should be supported by resilient hangers to avoid radiating sound.
3. Air-conditioning ducts feeding rooms should be arranged so that they do not allow "cross talk" between rooms. Air velocity should be kept below 1500 ft./min. and fan tip speed should not exceed 55 ft./sec. Fan casings should be resiliently mounted. Air supply vents should be of an appropriate size and its louvers canted moderately to avoid obstructing air flow.

Sound Systems

There are three basic types of sound systems employed in large-group media rooms: centralized, distributed and stereophonic (or quadraphonic). Each system performs certain functions better than the others, given different acoustical environments. Acoustical consultants prefer the centralized system, since it can be integrated more completely with the acoustical characteristics of the room and thereby bring out the desirable acoustical qualities designed into the space.

In rooms having undesirably long reverberation times, it is often necessary to use a distributed sound system (the installation of several low-level speakers throughout the room). These speakers should be spaced in a ceiling so that there is no sonic overlap and, at the same time, no floor areas not receiving direct sound. An acceptable approximation of the distance between speakers in such a system can be determined by subtracting the number 4 from the ceiling height and doubling it, i.e., $d = 2(H-4)$. Sidewall locations for a distributed sound system are less desirable than ceiling locations because there would be much more overlap and chance of phase problems. A time delay system and loudness controls for individual speakers would be needed to make such a system functional.

The most popular type of sound system used in large-group media rooms which features music playback is the stereophonic sound system and, more recently, the quadraphonic sound system. A set of carefully balanced and properly located high-fidelity speakers can reproduce the quality and give the spatial separation desired for the playback of stereo and quadraphonic records and tapes.

Sound amplification systems should be chosen on the basis of the speaker system's efficiency and the volume and reverberation characteristics of the space. For most large-group media rooms, a unit capable of 30 watts per channel (continuous-RMS) with a wide frequency response (30-18,000 Hz) low distortion, background noise and hum should prove acceptable. It should be equipped with separate input controls for each microphone and other program sources, i.e., tape, record. It should be selected on the basis of quality, life expectancy and ease of maintenance as should the other audio components, i.e., microphones and speakers. A low impedance microphone system is recommended, and speaker and microphone cabling should be built into opposite sides of the room.

Thermal Factors

While visual and auditory aspects of a learning space are the major concerns of the media-facilities designer, thermal factors are also important, for they will affect the comfort with which visual and auditory tasks are performed. They will also affect, to a considerable degree, the placement and operation of audiovisual media.

The following are recommended thermal conditions for classrooms:

- Room temperature between 68-76° F
- Relative humidity between 30-60%
- Air velocity 15-25 feet per/minute
- 10-30 cubic feet per/minute of fresh air (with minimum of 10 cfm outside air) per person.

For equipment operation and storage.¹⁰

- Computer facilities: constant temperature of 75° with 50% relative humidity (RH); operational limits: dry bulb temperature 60-90°F, relative humidity of 20-80°F, maximum dry bulb temperature 78°F; recommended 1/4 ton cooling per C.A.I. station.
- Films projectors (slide, motion picture, etc.): 65-70°F and 25-40% RH.
- Film storage: below 80°F and 25-60% RH.
- Audio tape: 60-90°F and 20-80% RH.

Seating

Proper seat and desk design can be an important factor in determining a student's comfort in a learning environment. A chair's design should promote proper weight distribution; otherwise, compression fatigue due to improper blood circulation will result. Seats should not be restrictive, but should allow for variations in posture. Seat and frame which

¹⁰E.F.L. *Instructional Hardware/A Guide to Architectural Requirements*, Educational Facilities Laboratories, New York, 1970, pp. 63-98.

come in contact with the subject should be made of wood or some other thermally non-conductive material. The seat pan should be lightly upholstered (1"), with a slight depression in the buttocks area. The backrest should be designed to give major support to the lumbar region.

Greater economy of space and flexibility of use can be achieved by using chairs equipped with drop-tablet arms or drop-counter writing surfaces. However, if a large-group area is used solely for media oriented instructional purposes, then the continuous desk-counter with continental seating is recommended. If, on the other hand, the area is also used as a theatre or an auditorium, then the other alternatives should be considered. The literature describes these seating types in detail.¹¹

There are other less critical but important considerations concerning seating design—seating types, aesthetics of design, maintainability, ease of stacking, cost and so forth. These factors are adequately discussed in the literature.¹²

CONCLUSIONS

In planning a new educational facility it is important that the faculty and staff effectively communicate their ideas, needs, goals, etc. to the architect. One of the best procedures for doing this is by developing educational specifications. Educational specifications will serve as a guide to the architect in developing physical facilities which will suitably house a desired educational program and at the same time be sufficiently flexible to permit future change.

Recently the School Planning Laboratory of the Educational Facilities Laboratories, Inc., (University of Tennessee-Knoxville) prepared a series of questions designed to provide information necessary to the development of such specifications. It is suggested that those involved in either new construction or major remodeling projects use this outline and review these questions in developing their set of educational specifications:

- I. *Introduction.* Write a paragraph or two to introduce your curriculum area.
- II. *Educational objectives* should be summarized in a concise yet complete manner.
- III. *Discernible trends* should be stated in detail. Attention should be given to trends in curriculum offerings, course content, activities and enrollments, as well as to trends in physical facilities.
- IV. *Activities and enrollments* should be discussed in detail. These two factors, along with trends, will probably have greater bearing upon the type of physical facilities developed than all other factors combined.
- V. *Space requirements* should be based upon the activities, enrollments and trends, as well as the furniture and equipment to be utilized. The number of space requirements should be expressed in terms of square feet required for each space. No attempt should be made to describe dimensions or specify building materials, since these are within the province of the architect and the consultants. Include not only classrooms, but also all specific spaces such as teacher workshops, conference rooms and special storage areas.
- VI. *Storage requirements* should include the kinds, sizes and amounts of materials to be stored. Specific information as to type and desired location of needed storage facilities is important. Consideration should be given to portable and semi-permanent storage facilities in order to avoid hampering flexibility.
- VII. *Furniture and equipment* requirements should be given careful consideration. Recommendations should be based on utility, flexibility, comfort and safety.

¹¹Green, A.C. (Ed.). *Educational Facilities with New Media*, Department of Audiovisual Instruction (now Association for Educational Communications and Technology), Washington, E.D., 1966, p. C19.

¹²Guilfoyle, J. "The Science of Seating", *Industrial Design*, Vol. 18, No. 3, June, 1971, pp. 18-39.

Avoid letting personal prejudice and tradition dictate recommendations. Only those items of furniture and equipment which will actually be fully utilized in the immediate future should be specified. Consideration should be given to the utilization of as much portable equipment as possible, in order to permit maximum flexibility and ease of future change.

- VIII. *Special requirements* should consist of those physical features and facilities which are not normally included in a well-coordinated, functionally designed classroom. Such requirements generally exist only in such spaces as shops, laboratories, gymnasiums, auditoriums, music rooms and similar areas.
- IX. *Desired space relationships* should be described both verbally and diagrammatically. Careful consideration should be given to developing the best possible functional relationships between spaces within each department or grade level. Possible use of operable walls should be examined carefully. Some indication should be given as to the desired relationships between the various segments of the school plant.
- X. *General comments*, which are either not provided for or covered fully under other categories, may be included. Such comments should be relatively brief and should be confined to such matters as school organization, supplementary information about desired physical facilities and matters of a similar nature.

*Glossary**

Articulation Index: A method of predicting speech intelligibility in the presence of noise.

Color rendering index: Measure of the degree of which the perceived colors of objects illuminated by the source conform to those of the same objects illuminated by a reference source for specified conditions.

Color temperature: The absolute temperature at which a black-body radiator must be operated to have a chromaticity equal to that of the light source (a rating in degrees Kelvin which is generally used as an indicator of lamps appearance).

Decibel: The basic unit of measurement of a field's sound pressure level. Since this scale is logarithmic, an additive increase of 10 decibels designates an increase in sound power by a multiple of 10.

Footcandle: The unit of illumination produced on or at a surface by spreading one lumen uniformly over an area one foot square.

Footlambert: A unit of luminance (photometric brightness) resulting from a diffusing surface emitting or reflecting light at a rate of one lumen per square foot. The average luminance of any reflecting surface in footlamberts is the product of the illumination in footcandles by the luminous reflectance of the surface.

Illumination: The density of luminous flux on a surface (flux-area).

Lumen: The unit of luminous flux (quantity of light emitted at source).

Luminaire: A complete lighting unit including lamps, parts designed to distribute the light and protect the lamps and the electrical power connections.

Maximum Bend Angle: This is the widest angle from the projector axis at which a screen can deliver acceptable brightness to a viewer.

Noise Reduction Factor: The actual acoustical separation between two areas. A rating which combines sound transmission loss, effects of the area or areas of the boundary and the acoustical environment of the listening room.

*These definitions, although originating from various authoritative sources, have in many cases been modified by the author.

Reverberation Time: The time required for a sound in an enclosure to drop in sound-pressure level 60 decibels.

Screen Gain: This is a factor expressed in whole numbers and decimals which is determined by dividing the "output" of light from the screen by the "input" of light from the projector. This measurement is generally taken from different viewing angles in order to determine the screen's performance "curve".

Screen Reflection Factor: This is generally applied only to rear-projection screens and refers to the amount of room light which is reflected by the screen to the observer.

Visual Angle (Visual size): The angle subtended by an object in the visual field at the nodal point of the eye.

Budgeting for Learning Resources Programs

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INTRODUCTION

In many respects budgeting for the college or university learning resources program resembles budgeting for traditional academic library programs. Because the library's role is usually passive (the library serves when called upon)¹ it might be hypothesized that the Learning Resources Center should also be passive, even in those cases where innovative programs are responsive to expressed needs identified by personnel outside the center.

Learning Resources Centers and libraries have many similar functions. For example, Learning Resources Centers usually maintain and provide access to collections of instructional materials and display equipment. In addition, such centers usually provide equipment repair, materials production and consultation services concerning the utilization of learning resources. All of these services closely parallel those of a library. Due to the increased involvement of learning resources programs with teaching-learning programs, the Learning Resources Center has become more than just a supply center for learning resources; it now functions as the focal point for instructional development activities and as the agency within the institution that is most responsible for the faculty's proper utilization of the great variety of learning resources available. This Learning Resources Center, then, presents a unique set of budgeting and management problems that will be discussed.

Because the personnel of Learning Resources Centers work directly with media, they frequently are familiar with innovative approaches to teaching and learning. Thus, the Learning Resources Center program includes processes which provide resources and, at some institutions, also efforts to improve that institution's learning environment.

Yet, functionally defined goals for Learning Resources Center operations are usually lacking. This condition parallels the lack of functionally defined goals for higher education, in general. The attempt to measure program outcomes for Learning Resources Centers is extremely difficult. The ability to account for a program's consumption of resources by identifying products produced by the program is an essential element of good management. Budgetary guidelines for the resources to be provided to maintain a program must be formulated only after the following factors have been taken into account: objectives of the program; available resources; environmental factors; ability to measure the products or outcomes of the program and management abilities of those operating the program.

PROGRAM ANALYSIS

Program analysis in the educational technology field has not attained the level of sophistication of the traditional library operation. Studies such as *Library Effectiveness: A Systems Approach* by Morse², are not duplicated for learning resources programs, although

¹Patricia B. Knapp. *College Teaching and the College Library*. ACRL Monograph 23. Chicago: American Library Association, Association for College and Research Libraries, 1959, p. 1.

²Philip M. Morse. *Library Effectiveness: A Systems Approach*. Cambridge: The MIT Press, 1968.

it is assumed that many of the principles developed for book-libraries are also applicable to the library-type activities in learning resources programs. In the educational technology field the following questions need to be answered:

- What fraction of yearly funds should be spent to purchase materials, to rent materials or to produce materials?
- What type of support at what costs in resources needs to be expended to provide accessibility to the instructional materials available?
- How can the usefulness of an item and its role in the attainment of the institution's goals be determined?
- When an item desired is out of the collection and of the somewhere else, can measures be identified that indicate the loss of utility?
- Which of the institution's programs require greater or lesser support from the Learning Resources Center?
- What are the criteria for determining a program's adequacy?
- What impact will various forms of delivery (i.e., electronic versus physical) have on the use of resources and the availability of these resources?
- What data need to be gathered in order to undertake a scientific analysis of a learning resources program in an attempt to identify its role in providing institutional service?

Analysis of the learning resources program will be based on a knowledge of what the program is, what it has, and what measurable units it has produced.

PROGRAM STATISTICS

Statistical analysis of educational technology center programs is an essential activity for comparing programs and identifying the factors within a program that can relate to the program's output. One of the difficulties encountered in examining and comparing the operating programs, or finances, between higher education institutions is the lack of data that can be compared among institutions.¹ It is important to ask the question raised by Fussler and Simon: "Will any kind of statistical procedure predict, with reasonable accuracy, the frequencies with which groups of books with defined characteristics, are likely to be used in a research library?"² This same question can be asked about the necessity for continuing to give learning resources programs high priority. These measures are needed as the programs are examined to determine if they have achieved their objectives.

There are many ways to use statistical data to analyze the past effectiveness of the program and to identify what now exists as a resource for future implementation of that program.

The following six steps can be used to develop the statistical core of any budget preparation.

1. Preparation of summary tables of all monetary resources devoted to the program. Most budgets consist of at least four basic elements: staff salaries for full and part-time employees; salaries for temporary employees, i.e., students; funds for supplies; funds for equipment.

2. Identification of the specific functions of the department. Management functions are always necessary. Other functions can then be specified, i.e., instructional design, photography, equipment maintenance, learning laboratories, audiovisual, TV production, film-making, film library, etc.

¹John Caffrey and Charles J. Mosmann. *Computers on Campus*. Washington, D.C.: American Council on Education, 1967, pp. 54-55.

²Herman H. Fussler and Julian L. Simon. *Patterns in the Use of Books in Large Research Libraries*. Council on Library Resources, Inc. Grant 64. Chicago: University of Chicago Press, 1961, p. 4.

3. Identification of subfunctions of each of the above-listed functions. These program components will generally reflect the goals and objectives of the program itself. For example, a main function—equipment maintenance—is listed, and below it are shown the subfunctions—consultation; equipment evaluation; design, maintenance and modification; installation, design and construction; training and supervision; inventory control and records.

4. Identification of the staff associated with each of the functions and subfunctions. Most people do not spend 100% of their time doing assigned tasks, but, in fact, may spend considerable time in consultation with other departments.

Approximation of the time spent by each person in each of the subfunctions. Each person's time must total 100%. If some of the subfunctions do not fit into an employee's job description, then more subfunction categories may be added. List these as a percentage of employees' time. (The utilization of the above procedure makes possible the identification of the staff members associated with each of the department goals and objectives or major functions. In addition, it serves to pinpoint areas of employee interests.)

5. Identification of the characteristics of the institution in which the program will operate. Determination of the environmental factors and their effect on the program and, ultimately, the resources consumed.

6. Identification and tabulation of the units of service provided patrons during the previous two budgetary periods and the current budgetary period. Examination of these tabulations for trends.

Before the budgeting of resources for a defined program can be undertaken, one must identify the institution in which the program will operate, the patrons to be served, components within the program that will lead to an achievement of defined objectives and the service patterns previously operated. Program planning based on the foregoing information will precede the budgeting of available resources needed to operate the program defined.

PROGRAM PLANNING

A program plan is an essential element in the management of a Learning Resources Center. The program needs to be available for inspection and, indeed, *should* be inspected in an attempt to ascertain if the program planned is the one needed by the institution.

Planning is a "futuristic" activity. As such, it should take into account all available resources required for predicting the program objectives which will meet the future needs of those relying upon the program. This implies predictions about (1) the demands that will be placed on the academic institutions by society at some point in the future, (2) the impact of the institution on society, (3) the role of the Learning Resources Center within the academic institution in meeting the demands and supporting the institution's programs and (4) the consumption of resources by the institution and its subunits in providing the programs needed to meet the identified objectives.

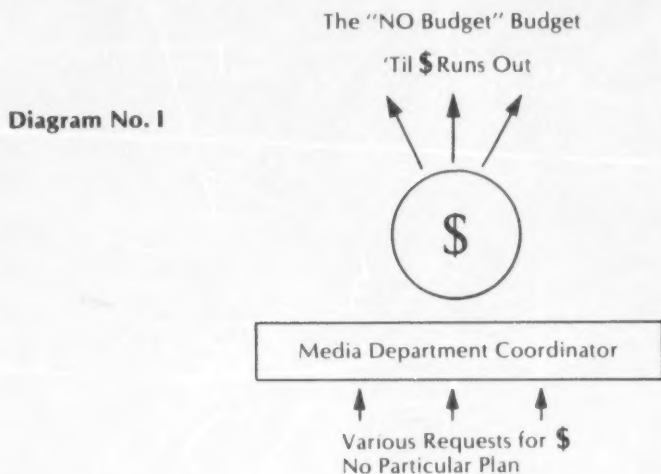
The further into the future planning moves the less precise it becomes. Precision tools are necessary for predicting the resources needed to operate a program identified in the medium and long range planning activity. One such tool was developed as "A Resources Prediction and Allocation Model for Audiovisual Centers in Higher Education." This model allows for an examination of a variety of learning resources and provides a prediction of the resources that will be consumed in the programs defined. Further development and validation of these management tools is a desirable activity.

TYPES OF BUDGETS

In general, there are four basic types of budgets. These are discussed and developed from simple to complex below. The first type of budget is more closely related to emotional appeals and subjective value judgments, and each type thereafter moves away from such subjectivity towards developing performance criteria that relate to some kind(s) of productivity or output factors.

No-budget budget

- A department or agency is provided with an amount of funding as a result of emotional appeals and subjective value judgment. These funds come from a central university office.
- The funds are divided on a first come, first served basis, with each department or agency obtaining "its share," which is generally an augmentation or reduction of the previous year's funding level.
- At various times during the year, the department or agency can return to the central university or college office and request additional funds based on new needs and expenditure requirements.
- The funds are provided from the central office of the college or university *until* they are depleted.
- The screening process for deciding which funds are to be allocated to each department or agency is *not* based on program output and is not tied to school enrollment, but is linked instead to available funds.



Performance budget

- The Central University Office divides the total funds available into two or more basic categories. Such categories could be (1) capital outlay expenditures and (2) consumable performance funds.
- The Central University or college office usually retains complete control of the capital funds and delegates various consumable funds to deans or other department heads.
- The Dean's office then allocates to the departments limited amounts for a specific funding period (fiscal year).
- Departments become managers of specific funds provided for this funding period, based upon their operating needs for that fiscal period. When departmental funds have been depleted, no more are available—unless additional departmental expenses are requested from a dean's office.

- If additional departmental expenses are requested this office then becomes a "screening agent" for determining priorities in requesting additional consumable funds from the central office.
- The Dean's office, acting as the screening agent, provides yearly allocations based on individual department priorities and needs and is able to *balance* funding levels between departments, based on such performance functions. (This characteristic illustrates the difference between a *performance budget* and the *no-budget budget*.)

An additional type of budget is a variation of the performance kind with several levels. This is typified by having two or more "screening agents" between the top and bottom; i.e., Central Office, Dean's Office, Department Chairman's Office, Division Office, Subdivision Office.

The "Performance" Budget

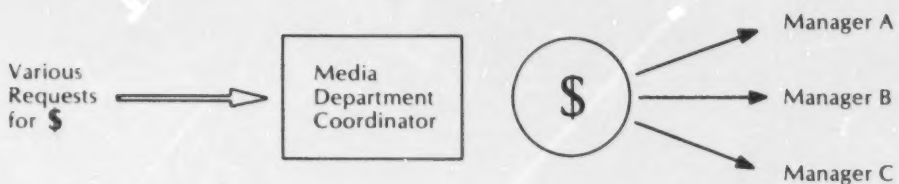


Diagram No. II

Line-item budget

- The central university or college office receives advance information from the using department relative to funding levels for each kind of need.
- The items of expenditure for the requesting departments are listed and a specific amount of money is allocated to each "line-item."
- The central university or college office makes a yearly (or periodic) review of the line-items according to priorities.
- The using department governs its own funding affairs within the parameters of each line-item category, spending from the specific categories within pre-established limits which are prescribed either by: a compromise between the using department and the central office prior to the funding period; directives issued by the central office to the using department; or a "prepared budget" drawn up by the using department previous to the funding period and accepted by the central office screening agents.

Examples of line items may include such things as: telephones, travel, office supplies, film, utilities, equipment, repair supplies, test gear, replacement items, etc.

The "Line-Item" Budget

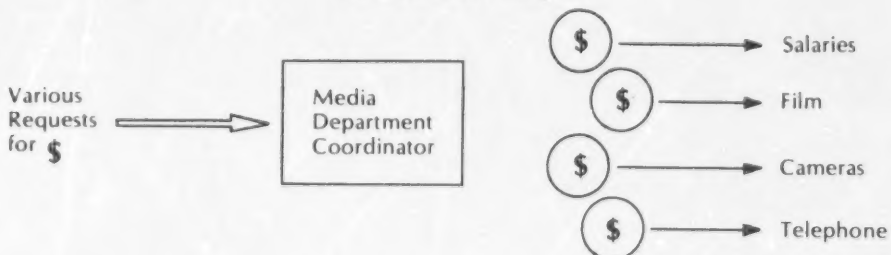
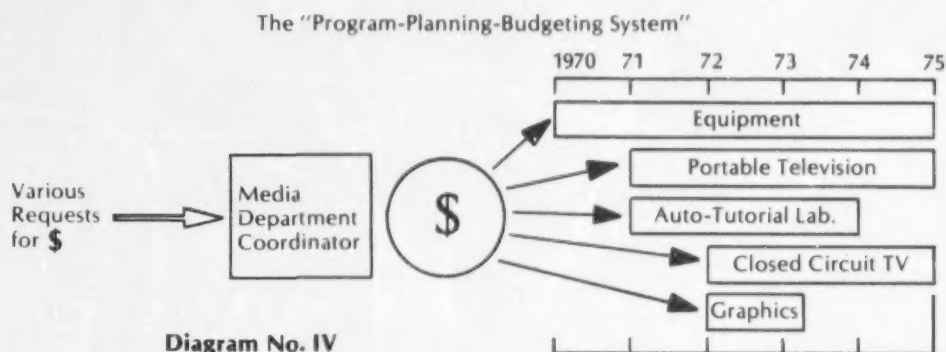


Diagram No. III

Program-planning budgetary system

- The central university or college budget office provides funds to all user levels (office and department) based on past years' function or performance. Past performance data are then arranged in an "average-growth" (or reduction) format to estimate the future requirements of that program. Resources needed for the new budget period are predicted on the basis of past performance and defined need. (Usually, program data which has been obtained over a period of two or three years is used as a basis for estimating current and future data up to a period of two years.)
- The future prediction process includes alternatives for review by "screening agents" in order to determine what resources are required to provide for growth in "determinable quantities". These alternatives are shown separately from the yearly projection plans.
- The screening agent is, therefore, able to consider the entire operation in planning for funding levels, and can thus allocate funds to achieve levels of output performance.
- Defined goals and objectives of user departments can be used to examine and evaluate the "budget model" described above. Such goals can be closely correlated with student body size factors for total program analysis.
- Because the process of change can be dealt with in an orderly and flexible manner, "emotional appeals and value judgments" can be reduced.

**BUDGET PLANNING**

As can be seen, program planning is closely related to budget planning. The statement of the fiscal, material and human resources needed to operate a specific program should be a direct reflection of the program planned. The budget follows the program, both in preparation, sequence and in content. Budgets are financial expressions of programs. Before budgeting can be accomplished, the components of the program being budgeted need to be identified. Planning systems that integrate the program planning and budgeting present a logically consistent approach for examining the expenditure of resources for specific operations included in the planned program. Program-based budgets lend themselves to systematic budget analysis and planning, which includes the use of decision-making tools such as resources prediction formulas. Provision of resources for programs can be structured and studied based on an application of scientific management principles.⁶ There is a danger, however, especially with program budgeting, to equate budgeting with planning.⁷

⁶Richard M. Dougherty and Fred J. Heinritz. *Scientific Management of Library Operations*. New York: The Scarecrow Press, Inc., 1966, p. 17.

⁷Hartley, Harry J. *Educational Planning-Programming-Budgeting, A Systems Approach*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968, pp.2-3.

In budgeting learning resources programs, a program-planning-budgeting (PPB) approach can be applied. The PPB approach is a management technique in which complex operations can be examined in understandable increments or parts that, in turn, can be properly budgeted.⁸ The PPB approach could eventually lead to a line-item budget that reflects the program planning that has taken place. Planning is based on an analysis of the needs for the operation being planned plus the identification of the elements of the operation to be provided. Utilizing a systems analysis approach in the PPB process, according to Fazar, provides for the following elements:

- Defining of objectives and goals of the programs.
- Identification of alternative procedures for meeting the objectives.
- Identification of the needed resources and the costs to carry out alternate plans for meeting the defined objectives.
- Creation of a model of the operational system that could be used in meeting the defined objectives—critical examination and evaluation of the model system.
- Identification of evaluation criteria to determine if the program in operation has met the defined objectives—establishment of procedures to allow for a redesign or redirection of the program to better meet the defined objectives.⁹

Formula budgeting or resource prediction systems, should such formulas or systems exist, can be utilized as integral tools in the PPB approach, as alternative methods for achieving program objectives are considered. Resource prediction formulas should provide indications of the resources necessary to operate the program components identified as leading to the defined objectives.

Implicit in a PPB system is the continuous process of review and analysis of all program activities. The review of the total operation is undertaken based on the current objectives (which may be different from the objectives at the time the operating system was created).¹⁰ Prediction of needed resources and budgeting through the application of formulas will not provide this review, nor will they assist in redefining objectives of programs. Formula budgeting systems are only tools for making management decisions—they are not management systems in themselves.

In preparing budgets for the Learning Resources Center programs, the following points should be considered:

- Each Learning Resources Center program should have at least an immediate program (for the current business year) and a medium length program plan (for the next five years). These programs need to be based on the objectives of the institution and need to reflect the objectives of the Learning Resources Center program.
- The program plans and the budget statements should be prepared by personnel from the Learning Resources Center.
- Control or management of resources once allocated should rest with the personnel within the Learning Resources Center program.
- Cost accounting procedures should be employed with the Learning Resources Center.
- Learning Resources Center programs, as with other institutional programs, should not be based on extramural ("soft") monies.
- Cost recovery (charging for services rendered) should not be the main source, if a source at all, of revenue generation for the program. (Charging for learning resources services frequently discourages the use of such services.)

⁸Harold R. Jenkins, "The ABC's of PPB," *Library Journal*, 96, October 1, 1971, p. 3090.

⁹Willard Fazar, "Program Planning and Budget Theory," *Special Libraries*, 60, September, 1969, p. 425.

¹⁰National Education Association, Committee on Educational Finance, *Planning for Educational Development in a Planning, Programming, Budgeting System*, Washington, D.C.: National Education Association, Committee on Educational Finance, 1968, p. 7.

- Program output should be examined to determine if the resources consumed have enabled performance objectives to be met.

Just as quantitative standards cannot be used to describe all programs that should exist at all colleges or universities, it is not possible to provide funding levels for precise programs that can be used for budgeting. Rather than serving as a design for a series of programs that can be accepted for a variety of institutional settings, these standards provide guidelines to be followed in developing a program and identifying the resources needed to operate that program.

REVENUE GENERATION AND FUNDS ALLOCATION

Generally, the funds needed to operate learning resources support programs are obtained through one or more of the following three tracks:

- Direct program appropriation
- Self-support
- Combined self-support/direct appropriation

All three of these sources are related to programs both as planned and as operated. It is not the intent of this section to recommend one funding track over another. The funding track must relate to the institution and its program.

Direct Program Appropriation

Every learning resources program, including its support services, will be part of a larger institutional program. The institution generates revenue from a variety of sources; the individual programs within the institution receive an allocation from the resources of the institution.

With a direct appropriation and ultimate allocation of funds, the defined program will be the basis for decision making. Following this funding track, the source of program operating funds will be the institution's treasury. The program will not, by its operation, generate funds from services performed.

Self-Support

Budgeted funds (those allocated yearly for ongoing functions) are often difficult to come by. Central budgeting authorities frequently feel that the support for learning resources needs should come from users of the services. By self-support the service receives funding for its services in direct support of or payment for services from those faculty members or departments served. In many cases services are provided to the non-institutional community for a service fee. This is most frequently seen in the operation of rental motion picture libraries or contracting to perform specific services such as equipment repair or graphic materials production. These services should be considered peripheral to the institutional support program, even if they generate income and operating monies for the institutional program, and they should not detract from the basic institutional support activities designed to meet institutional objectives.

Advantages of self-supporting programs include:

- The learning resources service is based completely on utilization trends by faculty, and is, therefore, almost completely accountable for all functions.
- The program is more "cost-effective" and can easily be measured in numerical terms.

Disadvantages include:

- Innovations to improve instructional methods may be curtailed by the cost of the support services.

- Spin-off effects are reduced. Qualified staff outside of the learning resources program often have talents which can be used by the college or university in planning for future instructional uses of electronic materials. A charge-back system may tend to discourage their assistance in other departments.

Combined Self-Support Direct Appropriation

The process of combining the above two methods of budgeting seems very common and yields desirable results if administered according to the following guidelines:

- No charges are made by the service department for work done in support of the academic instructional classroom faculty teaching-learning program where students receive academic credit.
- Charges for services provided by learning resources staff and equipment utilization are made to campus departments (agencies, institutes, offices, student organizations, etc.) which engage in activities not specifically associated with the faculty teaching-learning program.

This combination system mixes the advantages of both and answers the problems of either by providing sufficient supervision within a learning resources organization. This supervision function can: encourage faculty teaching innovation; coordinate additional campus-wide communication needs with staff; and provide for wider dispersion of useful ideas throughout the entire campus, as well as be an administrative link with the central college or university administrators to make decisions about campus and academic planning. Further, such supervision can act as a "gate-keeper" in making decisions about what quantities of support are given to which instructional programs and can respond to budgetary requirements of keeping the program measurable and accountable.

This combination budget system is, therefore, recommended for both a new learning resources department and also for a continuing department that is re-defining its service and accounting for the budgetary requirements of the program in statistical terms.

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